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April 25, 1925

The World's Gold

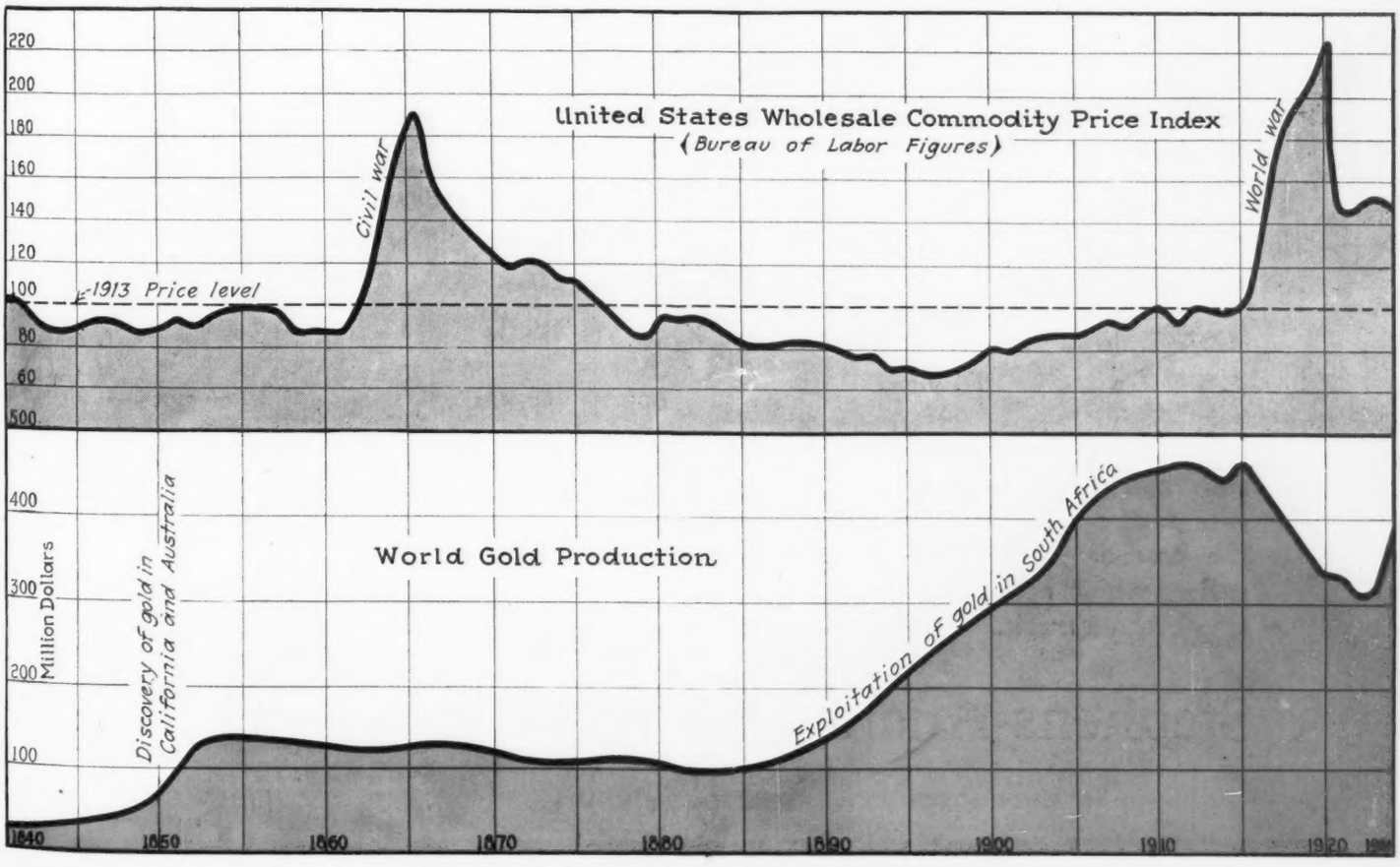
By J. E. Spurr

Bauxite Deposits of British Guiana

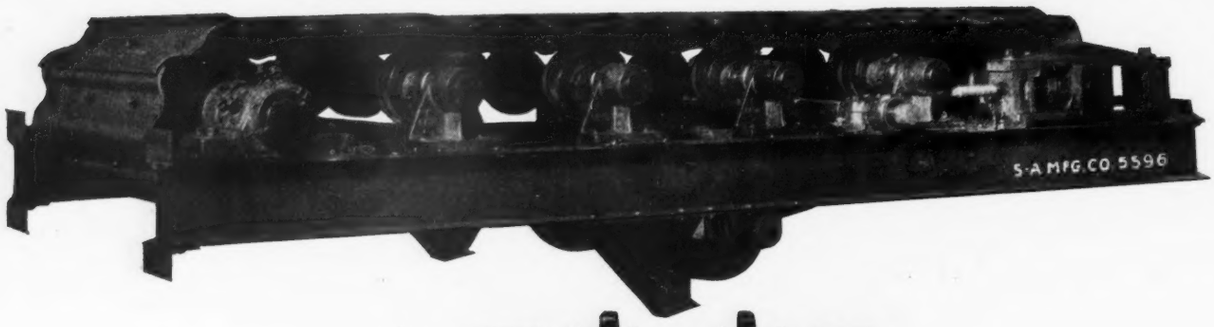
By Lloyd T. Emory

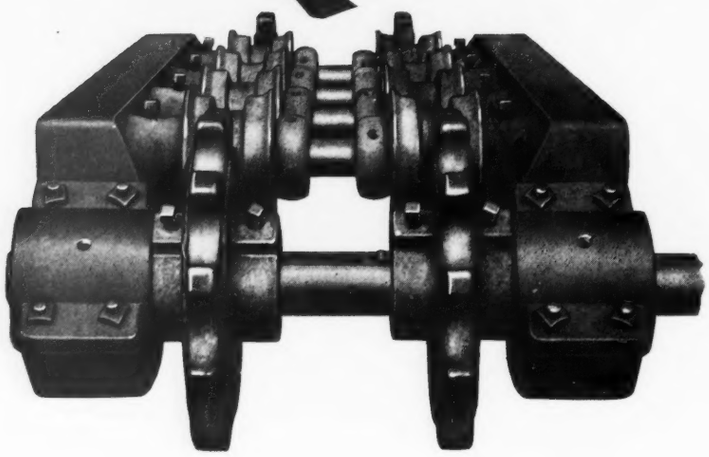
Determination of Xanthate in Impure Solutions

By A. F. Hallett and Frank Ryder



Curves showing relation of world gold production to commodity prices in the United States





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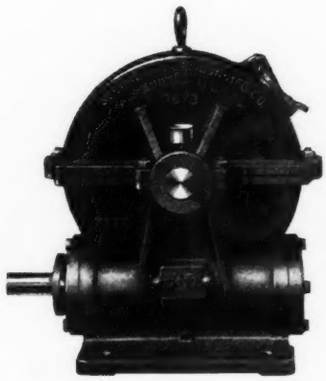

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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

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Scientific Utilization of Mineral Resources

PRIOR to the Great War little was heard concerning the problem of a national policy in the United States as to the exploitation of its mineral resources. European governments, however, had a fully developed mineral consciousness, more acute in cases like France and Germany, with their coal and iron problems breeding perennial mutual strife and antagonism; growingly acute with Great Britain, which till recent years has been "sitting pretty" as to coal and iron, but with an increasing poignant necessity for world-wide petroleum resources. To the American, confident that the unprecedented increase in wealth and power of the United States was due to his own surpassing ability, the belief came easy that the abundance of mineral products in the United States was a direct result of this human superiority: and as there was no end to the superiority, there would be no end to the minerals. Q. E. D. The utmost that would be necessary in any extreme would be a tariff, to protect the flagging metal or mineral industry in question against foreign competition through cheap labor, lower standards of living, and the other horrid things that threaten the equanimity of the Sunday School at home.

From this happy and guileless state of mind, the war awoke certain of the more thoughtful citizens of the United States, even if it did not awake the average citizen. To the surprise of the latter, even the post-war panacea of the tariff did not resuscitate, according to the label on the bottle, certain struggling mineral industries. Instead, after the tariff dose, they relapsed into a dangerous state of coma. Year by year the knowledge is gradually spreading that the mineral resources of the world, including those of the United States, are limited; that they are being rapidly used up; and that their approaching exhaustion is easily computable in general terms. While we have at the moment more than we need of petroleum, it is now commonly acknowledged that this situation will probably not last for decades. As for lead, the relative present shortage is manifested by the high prices. Plans for the conservation of petroleum have been suggested, first by students and government officials, and lately by an operator, Henry L. Doherty; and the President has appointed a committee of his Cabinet to meditate on the problem and suggest a remedy—or, more modestly speaking, a policy. The indications of an approaching shortage of lead are world-wide; and in this also conservation has been suggested: and the method talked about has been the refraining from the use of lead as a paint.

The oldest call for the conservation of national resources came in the case of forests. The result was the setting aside of the Forest Reserves and the organization of the Forestry Service. Yet even in the case of forests, no satisfactory or efficacious program of conservation has been found. The evil has not been checked. Even the word conservation is not altogether a popular one: it suggests hoarding, when what we want is scientific regulation and management of our natural resources.

That is the trouble with our mineral problem. It is not a question of bare conservation—of keeping the ore in the ground; it is a question of getting the most out of it, for the nation. So that what we need now is what we have always needed since the problem of facing the wastage of our natural resources began: the enunciation of a sound economic mineral policy. If we fail to find this, and have it approved by the government and the people, comments on the situation will be in the future as futile as they have been in the past.

The Reports of Utah, Ray Consolidated, and Nevada Consolidated

BUSINESSLIKE, frank, informative, and easily intelligible, the annual reports of the porphyry copper companies seem to us this year more interesting than ever. To our mind they are first-class examples of what a mining company's yearly record should be, especially when that company has been financed by public subscription of its bonds and shares. Each of the porphyry reports contains sufficient information to give the reader an excellent picture of the company's progress, without being too voluminous and without bringing in detail of little use to the stockholder. Yet the reports furnish very intimate facts about each operation. Does the shareholder wish to know the price per pound received for the metals sold? The cost per pound produced? The cost of churn drilling? Answers to these and similar questions may be found in the reports. No tedious calculations, tempered with much guesswork, are required to find out just what it costs these organizations to mine and treat its output. Unlike a good many reports, the data are there for all to see.

Incidentally, the financial statements of the porphyries show that they have been able to make some money even at the low price of copper prevailing in 1924. Utah Copper earned $5.04 per share on its 1,624,490 shares outstanding (par $10); Ray Consolidated made 32c. per share on its 3,077,179 shares outstanding, while Nevada Consolidated showed earnings of $1.05 per share on its capitalization of 1,999,457 shares (par $5). All the properties are in splendid condition. In fact the only disturbing and yet gratifying feature of the reports, if it may be called that, is the statement that the properties, Nevada, Ray, and Chino in particular, "have never before been in such perfect physical condition as now, or so ready to respond rapidly and with increasing efficiency to production requirements."

It probably goes without saying that the porphyry

companies will not increase their output with the present state of the copper market, but the remarks in the reports verify what has been rather widely known all along, that the copper companies have spared no expense or effort during the last few years of an unsatisfactory copper market in improving their plants and processes. They will be ready for a better copper market—when it comes.

It is always a keen pleasure to read the porphyry reports.

Wanted—Aluminum Production Figures

METAL PRODUCTION FIGURES expressed in value of output give a minimum of information. A month ago in a press bulletin, under the heading "Production of Aluminum in 1924," the U. S. Geological Survey stated that new aluminum produced in the United States last year had a value of $37,607,000, an increase of about one-third over the value of the output in 1923. "Aluminum of 99 per cent grade was quoted at 27c. a pound during the first week in January, but the price rose to 28c. and remained stationary until the middle of March," stated the bulletin. "During April, May, June, and July the price was 28 to 29c., but in August it was 28c., where it remained until the end of the year. The price of metal of 98 per cent grade was steadily one cent under that of the purer metal." Nothing more than this was said about production in the bulletin. Let the reader then try to figure from this data how much aluminum, in ingot, sheet, and other forms, was produced in 1924. Answer: it can't be done, no matter how good a guesser the gentle reader is.

We do not quarrel with the Survey: it is certain that had the production figures been released the Survey would have published them, as it does with other metals and mineral products, among them bauxite, the principal aluminum ore. The bulletin on bauxite, just received, gives the 1924 production of that mineral in the United States as 346,553 long tons, of which 326,616 tons came from Arkansas. Imports were 201,974 tons, an increase of about 70 per cent compared with 1923, most of this coming from the Guianas, South America. All these data are in interesting contrast to the meager facts that have been given as to metallic aluminum.

It is, of course, readily understood that the policy of secrecy of the Aluminum Company of America is responsible for the lack of information regarding its metal output. This company dominates the industry at home and, it is said, controls over 90 per cent of the world production of aluminum. Apparently it controls other things as well, as its ability to get and keep a tariff increase on its products seems to show. More light on this matter would be a welcome development in 1925. The Survey should apply to Secretary Mellon for information.

The Rodrian Process Again

IT HAS BEEN over two years now since we paid our respects to Herr Richard Rodrian and his electrometallurgical process—in our issue of Jan. 6, 1923, to be exact. Meanwhile, the $5,000,000 plant that was to be built to separate the gold from the hill at Gold Hill, North Carolina, remains a figment of the imagination; the Supreme Court of New York State has prevented his company from selling stock; and his process has been thoroughly investigated by the Bureau of Standards and in the metallurgical laboratories of Columbia University, one of the editors of *Mining Journal-Press* being present at the last-named test. The $1.50 ore that was treated by the Rodrian process in the Columbia tests, and in the presence and with the approval of Herr Rodrian, yielded 23c. per ton, we understand. Naturally, business has not been so good lately for the Rodrian Electro-Metallurgical Co., so why not make a fresh start?

Apparently, though, the glove business has been pretty good, and glove manufacturers and associated business interests of Gloversville, N. Y., were found to have some ready cash available. Furthermore, Pinnacle Mountain, just north of Gloversville, had plenty of rock which had never been proved not to contain gold and which the unsophisticated might be taught to consider likely looking stuff. No good use for Pinnacle Mountain had ever been found before, and the good people of Gloversville had been brought up to believe that there is a divine purpose for everything, so why not for Pinnacle Mountain? Accordingly, the North American Mining & Reduction Co. was formed to extract the gold, which name was later simplified, we understand, to the Northern Reduction Co., thereby not committing itself, in name at least, to do any mining or milling, and not specifying whether ore or pocketbooks were to be reduced. Money was raised not by the sale of stock but by subscription to "beneficial certificates" or something like that, E. C. Naylor, president of the Trust Company of Fulton County, taking 10,000 shares; Charles B. Brice, wealthy leather merchant, 6,000 shares; Dr. Alex Johnson, health officer of Gloversville, 1,000 shares; C. E. Metzger, wealthy merchant of Warren, Pa., 4,000 shares; W. D. Welch, wealthy insurance broker, 4,000 shares; and Abner Steele, manufacturer, 1,000 shares. These are only a few of the mining engineers that are backing the scheme. Herr Rodrian promises the first "pot of gold" in two weeks, while representatives of the Attorney General's office and the loyal stockholders patiently wait. Any further financial underwriting of the project has been stopped by the state authorities under a law just enacted.

Fortunately, Herr Rodrian's process for extracting gold does not depend upon the gold content of the rock that he treats. His process may therefore be applied to the rock of any state, county, or town. Those who wish to have their own back yards developed should forward appropriate funds. Herr Rodrian will probably have time to consider other development propositions in two or three weeks.

Corrosion Waste

THERE ARE TASKS that never end. Painting the Brooklyn Bridge is one. Continually the work of applying a fresh protective coat to save the metal underneath progresses methodically along the structure, and, when the end is reached, it starts again at the beginning. So it is with other bridges and with all structures the steel frames or sides of which are exposed to the action of the elements.

That iron and steel should rust was long taken for granted. To protect it properly was the problem. But ideas change, and corrosion is now looked upon as the

enemy of industry—an enemy that will destroy plants, machinery, and equipment, if let, and often whether you will or no; an enemy the cost of whose ravages has often been ignored or camouflaged in cost sheets as depreciation, maintenance, or repairs. The annual national loss in metals that it causes has been estimated at between $200,000,000 and $300,000,000.

Efforts to combat this enemy are now well organized, and advance is being made. Various national bodies have their corrosion committees engaged in studying special phases of the problem. Recently, in Baltimore, a symposium on corrosion was held by the American Chemical Society's industrial division which its committee had prepared as a step in its study of the subject. As a result of the work done, we now know electrolytic action to be the cause of rust. The electrolytic theory applied to corrosion was first outlined in a practical way in 1913, since when it has not been successfully contradicted. Work of the last two years has definitely established its correctness; electricity generated by the chemical action of water and air, especially when combined, has been found to be the principal cause.

In mine and mill the enemy is present everywhere. Underground—cars, drills, rails, piping, pumps, and tools; in the mill—tanks and equipment of all kinds and the building itself are subject to its ravages. The waste is great. Paint, by itself, is just a makeshift. Much good work has been done in the way of special metals and alloys. Pure iron is seemingly immune. But not until a practical way is found of preventing corrosive action from starting in iron and steel can the problem be said to approach solution.

Greek to the Rescue

THE EDITOR of this paper was once much interested in a phenomenon which he observed in a mine in Mexico—the Zaragosa, near Monterey. The ore was in part a light-yellow ("rosin") blende. When the point of a pick was drawn over it in the mine, it glowed like a damp match—brighter than the dial of a watch treated with luminous paint—and presently the glow died away. This characteristic was so marked that if a specimen of the blende were held in the shadow of one's coat, and scratched, the luminous streak glowed plainly. We wondered why this was true of this blende and not of blendes in general; but we sought in vain among geologists for an explanation. At length we found a wise mineralogist: "Oh, yes," he said; "I can tell you what causes that. It is due to triboluminescence." "And what," we persisted, "is triboluminescence?" And we finally elicited the information, between the mineralogist and the dictionary, that triboluminescence is the quality of glowing when rubbed. The Greek is "tribo"—"I rub"; the Latin "lumen," a light. I rub in Greek and I get a Latin light. "But to what," we persisted rather unconventionally, "is triboluminescence due?" "As to that," was the lofty reply, "we do not know. But what you observe is due to triboluminescence."

It has been pointed out by the editor of this paper that certain veins or veindikes give evidence of having been in a dense and jelly-like form in many cases, before crystallization; so that this ore jelly, or gelatinous ore magma, has held suspended solid fragments of country rock and of earlier-formed ores, while the dense solution crystallized. We explained to a physicist that the phenomenon suggested a transitional gelatinous state between fluid solutions and solids—a state which came at a certain stage in the process of cooling. He answered that he thought that was unlikely. And presently an alternative explanation was brought forward to explain this staring fact of suspended fragments in fissure veins: they were due to colloids. "And what," the persistent seeker after truth asks, "are colloids?" Again the dictionary helps: the word is again Greek, meaning "like glue" ("colla," glue). The dictionary further defines: "jelly-like substances." Colloids, we further learn, are gelatinous solutions which represent a transition stage between fluid solutions and solids: they represent a stage through which all cooling or other crystallizing solutions, including rock magmas and ore magmas, must pass, and linger for a shorter or longer space. And here we have swept around the circle again as we did with triboluminescence.

The Greek language is a blessed refuge for the hunted scientist; but not quite so satisfying as a scientific haven for those who have even a smattering of knowledge of it, who have conned their Homer and their Herodotus. In this case, even a slight familiarity brings the reputed effect; and they prefer to think and talk in plain English when possible; and when they use the Greek they know it for a name and not a charm dispensing with the need of further thought.

Application of Geology to Mining

THE APPLICATION OF GEOLOGY to mining is not as simple a process as many imagine. Offhand, the impression is that on one side we have geology and the geologist; on the other hand we have the mine. Bring the geologist to the mine, and let him unlimber his scientific paraphernalia and get into action. Voilà—he has applied geology to mining! Not so—as well expect to bring out the university's mathematician, introduce him to the auditor's room of a great business corporation, and tell him to work out at once a financial policy. It cannot be done—he must have years of preliminary training in the application of mathematics and other things to industry before his opinion is worth the paper it is written on. Therefore the railroad president does not call in the mathematician, nor does the mathematician respond with a treatise on the law of probability as related to the life and prosperity of railroads, under the impression that it is a practical report.

But it does happen that the application of geology to mining is sometimes tried without the necessary years of learning how. It is as if the student should study anatomy and physiology: and then take up a case of typhoid. Between the geologist and the mine operator there is a wide gulf fixed by nature—a proper and necessary gulf. Who would bring the two together for mutual benefit—the benefit of science and industry alike—must spend years in training, learning how to bridge the gulf safely and surely. The geologist who is not schooled by years of study and practice in the knowledge of mining and of ore deposits, and the mine owner or prospective owner seeking this skill, should understand this clearly; the lack of it brings disappointment to the miner and undeserved and unnecessary discredit to the science of geology.

Australian Camps—Broken Hill, New South Wales

Right—The South Mine, of Broken Hill South, Ltd., which in the year ended June 30, 1924, produced 239,508 tons of ore running 12.8 per cent lead, 5.2 oz. silver, and 11.4 per cent zinc

Left—Looking toward the town from the Central Mine of the Sulphide Corporation. View taken April, 1924. Smoke in left foreground from fire in Central Mine, which broke out in July, 1923

Right—View northeast from Central Mine. The Sulphide Corporation's smelter is at Cockle Creek, N.S.W. A new sulphuric acid plant, superphosphate plant, and refinery have been added

Photos by courtesy of A. W. Newberry

The World's Gold*

By J. E. Spurr

WHY are the world's finances on a gold basis? The reason is almost—or quite—as fundamental as the reasons why cereals are used for food. In the remotest records of antiquity we learn that gold was cherished and esteemed and used as it is today. The inscription on the obelisks of Egypt and the tradition of the Aztecs and the Incas tell of the accumulation of gold by the rulers of ancient civilizations for ornamentation and for coinage. That Cortez demolished the Aztec Empire of Mexico and Pizarro ravished the Peruvian domain of the Incas for the sake of bringing back gold to Spain, is only one of a thousand instances, in a lesser stage of antiquity, of the desire for and the delight in gold, so old that it is almost natural. Yet the causes for this delight and use, as thus revealed, well established at the dawn of written history, are to be sought still further back—far back of history. Many modern writers and talkers argue that gold is a symbol for money; that anything else would do as well—wheat, platinum, stamped paper, or what not. But these thinkers are not analytical; surely the appraisal of gold as a thing of great value, which arose independently in many and isolated portions of the globe, and has been one of the instincts handed down to our day, is rooted in something real—the common sense of the whole human race could not have erred all of the time and throughout the world.

Qualities That Make Gold "Noble"

All this must rest on sound and sane foundations. What are they? First, as it is well recognized, comes the "noble" nature of the metal. It is practically indestructible—does not rust away, is not harmed by the natural acids that attack so many metals, nor by the organic foes which ruined the silken treasures of antiquity. It is beautiful and glistening, with a rich, agreeable and distinctive color; and this luster does not dim or tarnish, like that of the less regal metal, silver. It can be easily beaten or pressed into durable shapes, a reliable quality in the olden times, and one of the many that contributed to its selection for use in coinage; it can be easily divided and reunited.

A perhaps equally important quality is the nearly universal distribution of gold in the earth's surface. Gold is, to be sure, a rare metal. Among the metals which make up the earth's crust it stands forty-first. Yet there are few countries where gold has not at some time been obtained in sufficient amounts to be useful and valuable. Ninety per cent of the nickel of the world (by way of contrast) comes from a single district in Canada, and nearly all of the remainder from another district in New Caledonia; and it is essentially a stranger to most regions. Yet nickel is much more abundant then gold in the earth's crust, standing twenty-first in relative amount. Platinum, standing forty-fourth in order of abundance, comes almost entirely from two regions—the Ural Mountains and the Republic of Colombia. But there is probably no country of any extent, either of ancient or modern times, where gold has not been known and accessible, although the abundance has varied greatly.

Moreover, much of the gold in the past has been found in stream gravels and the gravels of the seashore—gold called from this habitat, placer gold—a condition in which it can at need be recovered by individuals without much skill and without mining operations. The specific gravity of the gold particles makes them settle in a pan or bowl or trough in which the sands are temporarily kept in suspension by twirling or rocking or an artificial current; and thus gold in a fairly pure state can be easily and cheaply recovered from gravels which may even contain only a few cents' worth to the cubic yard. This method of collection was known in antiquity. The fine particles of gold resulting from placer washing is called gold dust; it runs like sand; and in the early days in gold-mining districts this gold dust, kept in buckskin bags by way of purses, served as money, the value of the amount necessary being determined by pan scales.

Evolution of Basic Currency

We must not assume that gold was chosen as the standard of exchange by a conscious act, any more than that it could possibly be eliminated in the same way, or that the situation could be modified by any theory. In the primeval bartering, when all things were exchanged against each other, gold naturally, by its superior qualifications, became the pivotal commodity of exchange—a commodity, be it remarked, and not a device or a symbol. Thus in a way it became the standard of exchange, the common denominator. The unit of value, as trade increased, became more and more a given weight of gold; and with the wide diversity of systems of weights and measures in different countries, different units of gold value naturally resulted. The dollar of the United States is a certain weight of gold, as defined and fixed by law—a weight of 23.22 grains. The English pound sterling is simply another system of weights—it was originally a troy pound of gold by weight.

By way of parenthesis or digression, in a sense, I may here note that, from very early days indeed, silver naturally became (and again by the age-long process of competition and elimination) a little brother of gold—an accepted standard of value of less worth and usable as such in small transactions. Thus it became the money of the poor, as gold always was the standard commodity of the rich and of large affairs. Nevertheless, silver was a noble metal, could not be destroyed, as the precious silks and art treasures of old, by mould or weather, or insects; could be hid indefinitely without fear of ants or mice; and was well known in all countries, since it also is of wide distribution.

Relative Production and Value of Silver and Gold

Silver is reckoned thirty-seventh in abundance in the earth's crust, as against gold, the forty-first. But there is a wide gap in the relative abundance, available stocks, and production of the two metals. To take an example, in the year 1917 (any year will do as well as another) the world produced 170,000,000 oz. of silver

*The latter part of this article was published under the same title in the April number of "Foreign Affairs," and is republished in *Mining Journal-Press* by permission.

and only 20,492,994 oz. of gold. The gold production by weight in that year was somewhat less than one-eighth the weight of silver produced. On the basis of relative abundance produced—the ratio of supply only—gold would be worth eight times as much as silver. As a matter of fact, under conditions as they exist, the value of an ounce of silver is only one-thirtieth that of an ounce of gold; so that the demand for gold is seen to have established a marked relative premium in its favor as compared with its little brother, silver.

In 1913 the relative production of silver and gold was approximately as ten is to one, a ratio which also applies to the twenty-year period 1900-1920. While the bimetallists' dream of a fixed ratio of a value of silver to gold of sixteen to one would seem to be modest by consideration of this relative recent production, the actual appraisal of the world's collective business is that the quality enters into the value as an equally important factor of valuation, and this is reflected by the demand which fixes the present ratio, fluctuating as all price ratios naturally are. Besides all this, the relative value of the two metals is affected not so much by the comparative annual production as it is by the accumulated available and marketable supplies on hand. And gold, being more precious, has accumulated throughout the decades more persistently than has silver, so that the proportion of its stocks to those of silver is far greater than the proportion represented by the present annual production.

Before 1914 it was estimated that two-thirds of the new silver annually produced in the United States went into the arts. On the other hand, it is estimated that of the world's gold produced from 1492 to 1894, half was lost or absorbed in the arts; while since 1894 one-quarter of the gold produced has gone into the arts, including the manufacture of jewelry. Moreover, silver coins being in common use, the loss by wear is enormous, which is not so true of gold.

Altogether, the relative production of gold and silver, considered historically and statistically, seems to have had little visible relation to the relative value, as the following table shows.

Silver to Gold—Annual Averages

	Ratio of World Production	Ratio of Price per Ounce
1701–20	28 to 1	15 to 1
1721–40	23	15
1741–60	22	15
1761–80	31	15
1781–1800	50	15
1801–20	34	16
1821–40	30	16
1841–60	6	16
1861–80	10	16
1881–1900	17	25
1901–1920	10	31

Indeed, it will be noted that in the 180 years when the price ratio was between 15 and 16 to 1, the production ratio was approximately 26 to 1, while in the forty years 1880-1920, when the price ratio average was about 28 to 1, the production ratio was about 13 to 1. In other words, the greater relative production of silver corresponded secularly with the higher price; the lesser production with the lower price. The principal reason for this was, of course, the tendency to abandon the bimetallic standard, which tendency marked the period last referred to, so that the demand for the white metal for coinage diminished greatly. In 1873 silver was demonetized in the United States. "The United States," says Hepburn, "was the last stronghold of silver." After the Franco-Prussian war, Germany adopted the gold standard; and France, Italy, Switzerland, Belgium, and Greece suspended free coinage of silver for the public.

Nevertheless, the position of silver as a standard commodity of exchange is not only almost as ancient as gold, but nearly as persistent and important. Its intrinsic value, its beauty, and its relative resistence to corrosion still make it the natural choice for small coinage, and hence create a demand for use in small transactions and among the poorer peoples. Of such there are swarming millions, for example, in China and India, and here is a vast and constant market for silver coins.

Ancient Standards of Value Varied

In ancient times, and whenever and wherever trade was primitive and sluggish, the natural and well-tested standard commodities for trade and exchange—the more precious gold and the more common silver—may well have existed more or less as independent standards. Whenever trade has become more active and mobile, however, a comparison of the worth of one in terms of the other has been inevitable; and the natural advantages of gold—its greater metallic "nobility," its wider distribution, its greater relative rarity—have always determined gold as the criterion and standard, in terms of which the value of silver, as of all other metals, and, indeed, all other commodities, have come to be expressed. Silver coinage therefore has come to play a dual rôle—while it represents a certain intrinsic value, its current value can remain fixed in one way only—by letting it represent as a token a certain weight of gold. As such it is the noblest and most fitting representative and proxy for the standard metal—a proxy which is capable of division into small, easily ponderable and tangible units, which is not practicable for gold itself.

With the bewildering development of the complex civilization of our days, our knowledge of and familiarity with tokens and valid symbols of all kinds has increased. The invention and cheapness of paper, the development of the art of printing, and the increasingly important rôle of the printed word have operated to make written and printed agreements and promises valid—as good as gold, the sturdy phrase goes—when protected by strong and honest systems of human government, controlling through law. Thus the indispensability of silver as the proxy of gold has been lessened—indeed, removed—and it simply remains as a convenient member of the swarm of proxies which represent the regal metal, still almost unchallenged as the central commodity of the world.

Status of Paper "Proxies"

A government that has the confidence of its citizens, whose promise is regarded by them "as good as gold," can take a piece of paper, write on it that it represents a certain weight of gold—say ten dollars of gold—which it is ready to exchange for the paper at any time on demand; and such a token passes current readily among intelligent men as being the equivalent of the metal itself. In unstable governments the case is as different as one would expect. The more complex and active commerce grows, under trustworthy governments, the more the printed promise to pay in gold takes the places of the metal. Different forms of these paper proxies arise—after the government "notes" come those of the banks; and finally, as the financial

structure becomes trustworthy, and safeguarded throughout, the substantial and trusted individual makes use of the proxy, printed or written on paper. Hence, in exchange for commodities, I will in New York City accept gold—any gold, stamped with the stamp of any government, trustworthy or not, or uncoined—simply gold by weight, as in the most ancient days; or I will accept on the same basis the paper representatives of gold carrying the good faith of the United States, but not the paper bearing the assurance of the government of China, of Jugoslavia or Russia, for example, except on terms such that I may instantly convert it into the notes of the United States and regain my peace of mind; or, I will accept the gold proxies or notes of the banks, which are under the guidance and guarantee of the United States Government; or, I will accept the gold proxy of an individual, called a check, provided that individual, in turn, is sponsored for by the bank. And as my confidence grows with custom I come to regard the proxies of the United States, of the banks, of certain corporations and individuals, as unquestionably as good as gold. I take them from choice, as being easier to carry and exchange than gold. And I call all this, the gold and all its representatives, metallic, or represented by the printed or written agreement to pay in gold or its equivalent, money; and one form of money becomes to me as desirable and acceptable as another.

A Money-changer Who Knew Not Gold

Even in these fat and opulent and secure conditions, we come to fret at silver, and refuse gold. Indeed, in the labyrinths of commerce, the real standard may become unfamiliar. I have had a twenty-dollar gold piece surveyed with distrust in the financial district of New York by a girl cashier who stated that she had never seen one. Was it worth ten or twenty dollars? From this simple and guileless frame of mind it is easy for the stupid to get the habit of assuming that gold is not the basis for money—that the slips of paper are somehow of intrinsic worth, and that the gold could be dispensed with. I have heard a banker advocate this belief before a group of engineers in New York, who had invited him to explain the status of gold and of foreign exchange. Either through ignorance or crookedness, or both, untrustworthy or desperate governments play and prey upon this popular lack of intelligence, and unload upon their people paper tokens which they—the governments—cannot and never intend to make good. This type of organized and wholesale rascality has been practiced by the rulers of Russia, and Austria, and Germany, and Mexico, and other countries, to the bitter and disillusioning and ruinous end. There will always be a fresh crop of come-ons and suckers—whole nations of them—for rascally governments to rob, trading upon a past record of probity and honor.

Basis of Paper-money Circulation

And even in the best governmental and banking and business circles, the popular faith and belief in long-familiar paper notes is utilized, even if kept within bounds. The belief that a paper note for a gold dollar is "as good as gold," held in mind till it becomes in the popular mind not only the actual symbol for gold but in mental vision gold itself, permits the convenient practice of keeping the gold in the government and bank vaults and using the paper tokens far more freely. As the demand for money increases, the paper symbols afford a means of supplying it, which the supply of actual gold could not accomplish. The government has outstanding, then, more symbols than gold, only it takes stock, now and then, to see that the excess is not too great—for as it increases, the paper currency of course and naturally depreciates or decreases in value, in the power of buying commodities. At this stage complex psychologic and economic factors enter into the consideration of money, values, and commerce, difficult to appraise accurately and bewildering to most. In general, it would appear that the excess of paper symbols over gold really should lead to a depreciation of the paper. Actually, it seems likely that this does not happen until there is some breath of popular suspicion that the paper may not be redeemable on demand for the gold: that is to say, in effect, that so long as everybody believes the paper to be readily exchangeable for gold, it is as good as gold. And since the soundness of a bank depends not upon its ability to repay all of its depositors at once, but to pay all of its depositors who are likely to demand payment at any one time, the soundness of a national currency depends upon the ability of a government to redeem in gold all of it which by any possibility may be presented for payment during any limited period, even in a financial crisis. Its margin of safety is carefully studied and kept well within, by good banks and good governments. These governments are entitled, under present business conditions, to be rated as soundly and squarely upon a "gold standard." But the governments that pass this psychological limit suffer a depreciated and fluctuating currency, as France has done; and if this is persisted in, pass to a financial crash, with the utter ruin of the owners of its money, as Germany has done—where many thousands who had the usual psychologic faith in the value of the paper mark, government-guaranteed and stamped, lost all their wealth. In betwixt-and-between countries the currency depreciation depends largely upon the amount of gold that still remains behind it, together with a rough popular and international appraisal of comparison with the currency of a country which is firm on a "gold basis," like the United States.

The Post-war Flow of Gold to the United States

Although it was far from my ambition to try to analyze economic and financial problems, it is impossible to treat of the problems of the world gold resources and production, past and future, without determining the status and value of gold, its use and rôle, and the nature of the demand for it. And after a little further inquiry into the part it plays, I may proceed to analyze the phases of the gold problem which my experience as a mining engineer and geologist has made more familiar.

Due to the monetary chaos which followed the Great War, few countries remained financially sound—that is to say, the proportion of gold to paper money was in most cases small out of all reason. The United States money retained its soundness, thanks in large measure to the favorable balance of trade which drew from the rest of the world a flow of gold into the vaults of the United States, in payment for supplies of food, clothing, and war equipment sent abroad. Thus the United States accumulated about half of all the gold existing in the world. In regard to the United States money, there-

fore, the currencies of most other countries in the world—especially the countries impoverished by war, and living on credit—shrank in value. Even the British pound, formerly the measure of value and stability, depreciated greatly, leaving the dollar as the world's standard. The financial skill and will of the British have since then, however, been devoted to restoring the value of their currency, with the result that at the present writing it is worth nearly par. Soon, it is anticipated, it will regain its pre-war value. It will then be on a "gold basis"—on a "parity" with United States money. There is some question in my mind whether this is actually a gold basis—whether any currency with a fluctuating basis of gold and an excess of paper which fluctuates without much regard to the fluctuation of gold can actually represent in a real economic sense the value of gold, and conform to the economic laws that would govern a real, uncamouflaged, unwatered gold currency. Does it not seem reasonable that any watering dilutes the currency, even if it does so moderately and with such swiftly varying degrees of intensity that it is beyond the popular mind to distinguish between the 22 carat and the 10 carat currency—to use a metaphor?

All of these elements come into the problem of the relation of the current supply of gold to the gold reserve: both these factors being considered from the world standpoint and also from that of individual nations; and they enter into the further problems of the relation of gold supply to prices of other commodities, and to national prosperity and power.

The Present World Stocks of Gold

Let us consider the world's past gold production, its present stocks, and the annual increment of new gold. It has been estimated that between the years 1492 and 1894 the world's production of gold was over $8,000,000,000, of which about $4,000,000,000 remained as the world's gold reserve in 1894. By 1916 the world's gold reserve had increased to nearly $8,000,000,000, an increase of $4,000,000,000, out of a world production during that period (1894-1916) of about $8,000,000,000. During this period of twenty years, therefore, about half of the gold produced remained in the available gold reserve of the world, or about the same estimated proportion as between 1492 and 1894.

In former times the annual production of gold was not much. The "flood of gold," as the economists call it, of recent years, began with the discovery of gold in California in 1848. The above-cited figures indicate that as much gold was produced in the world in the twenty-odd years from 1894 to 1917 as in the four hundred years between 1492 and 1894! There is no more striking illustration of the feverish exploitation of national resources, which is an incident to our present-day industrial development, although it is paralleled in other mineral commodities (Fig. 1.).

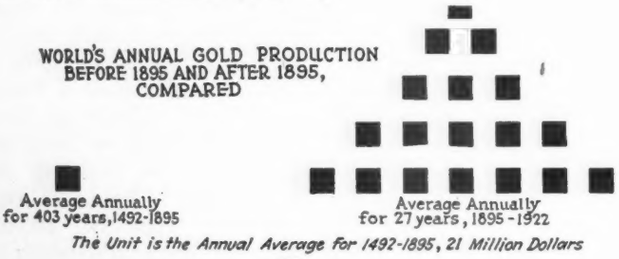

WORLD'S ANNUAL GOLD PRODUCTION
BEFORE 1895 AND AFTER 1895,
COMPARED
Average Annually
for 403 years, 1492-1895
Average Annually
for 27 years, 1895-1922
The Unit is the Annual Average for 1492-1895, 21 Million Dollars

Fig. 1

The greatest source of the flood at first was from "placer" gold. After California, Australia contributed to this flood, then Canada and Alaska, Siberia, and other regions. From 1848 to 1875, De Launay estimates that placers produced 87 per cent of the world's production: but these are now essentially exhausted, so that in 1918 Orchard estimated the placer contribution at not more than 10 per cent. Then followed the period of rapid exploitation of "lode" or vein gold mines, in various parts of the world—especially North America, South Africa, and Australia. The intensity of gold mining, which was only a symptom of the general intense development of mechanical civilization which characterized the same period, resulted in a world production, which, ever climbing, in 1896 passed the $200,000,000 mark; in 1899 passed the $300,000,000 mark; and in 1906 passed the $400,000,000 mark! In 1915, the world's production is given at $470,000,000, the high-water mark. Since this there has been a tendency to mark time or even subside. In 1917, the production was $420,000,000; in 1918 it dropped below the $400,000,000 mark with a world production of $385,000,000; in 1922, it was about $319,000,000; in 1923, about $367,000,000; in 1924, it rose to $384,500,000.

Exhaustion of Natural Resources Has Become Rapid

To understand and foresee the trend of developments as regards gold supply, production, and future reaction on the world's economic problems, it is necessary to realize that the world is now passing through an acute stage of exploiting its treasures of rich ores, which are definitely exhaustible. This exhaustibility is true in varying degrees of the different minerals—less so in the case of coal and iron, more so in the case of metals like gold and silver and platinum, of lead, tin, and manganese. And one of the reasons for the checking, in the last decade, of the sensational increase in the world's gold production, has been the beginning of actual exhaustion at the source of supplies.

At the present time, and for many decades past, the gold production of the world has been mainly from the United States and from the British Empire. Orchard has estimated that in 1913 the British Empire produced about 63 per cent of the total world production, the United States a little over 19 per cent. This accounted for 82 per cent of the world's production. No other country has relative importance. Russia and Siberia in 1913 produced about 6 per cent, Mexico 4 per cent; in 1921, Russia and Siberia produced three-tenths of 1 per cent, Mexico 4 per cent, of the whole. The production of the United States, of course, has come almost entirely from North America; while that of the British Empire has come principally from such widely separated domains as South Africa, Australasia, Canada, and British India.

There has been no nation so aggressively and intensely exploitative of national resources over a great area as the United States; and the result is that its rich mineral resources show signs, in many instances, of having passed the zenith. In 1915, when the world had its highest gold production, the United States also had its highest production and produced $101,000,000, or 21.5 per cent of the whole; but since then the percentage has been constantly decreasing, till in 1924 it was only about $52,000,000, or 13.5 per cent. H. N. Lawrie, writing in the *Mining Journal-Press* in January, 1925,

observes: "In 1925 the United States will become a still less important factor in the world's production, and with the very large increase which has been made in the production of Canada, it would seem probable that in a few years the Canadian production might supersede that of the United States, unless some constructive remedy is applied to improve domestic conditions."

While the gold production of the British Empire comes chiefly from autonomous dominions, there are open channels of trade and finance between them and England, as compared with trade and banking business versus non-British countries; so that it is fair to consider the British production as a whole as compared with the American production. The most spectacular flood of gold in the history of the world came between 1900 and the present moment, from the British dominions in South Africa, principally the Transvaal. By 1916, the banner year, the South African production had risen to over $211,000,000; in 1923, it was $202-500,000, or about 53 per cent of the world's production for that year. In 1924 South Africa's contribution to the world's output of gold amounted to about $210,000,000.

Canada has shown a tendency to increase its gold production. From an average of less than $1,000,000 annually previous to 1891, there was a steady rise, of which one of the principal factors was the placer gold of British Columbia; till at the year of the Klondike rush—1898—the Canadian production jumped from $6,000,000 (1897) to nearly $14,000,000 (1898) and to nearly $29,000,000 in 1900! As the Klondike placers waned, the gold quartz veins of Ontario, principally in the Porcupine district, came in to fill the gap, so that although the production along 1906-1909 had fallen to less than $10,000,000 annually, in 1916 it was $19,-000,000, in 1923 nearly over $26,000,000, and in 1924 still higher, reaching $31,500,000.

In Australia, the gold rush following 1851 came upon the heels of the California rush following 1848. For many years the gold production of Australia rivaled or equaled that of the United States, but about 1905 it began to drop behind, so that by 1914-15 it produced only half as much. The 1915 Australian production was over $49,000,000; in 1918 it was only $29,000,000; by 1921 and 1922 it had declined to about $15,500,000, and the situation has not improved since then, being $14,500,000 in 1923 and less in 1924.

British India's production, beginning in 1885, passed the $10,000,000 point in 1903, and reached its highest point, $12,000,000, in 1913. In 1918 it was $10,000,000; in 1922 and 1923, each about $8,000,000.

The total production of the British Empire, with all these varying factors, has increased from 27 per cent of the world's total in 1880, when the world's total was $106,000,000, to 70 per cent in 1923, when the total world's production was about $367,000,000. It will be interesting to compare the relative standing of the other principal gold countries at those two periods, and at two intervening dates selected:

World's Gold Production

In Percentages

	1880	1896	1918	1923
British Empire	27	27	60	70
United States	34	26	18	14
Russia and Siberia	27	11	3	1½
Mexico	1	4	4	4½
Other countries	11 (a)	32 (b)	15	10
	100	100	100	100

(a) Transvaal 2. (b) Transvaal 22.

The jump in the British percentage between the figure shown for 1896 (27 per cent) and shown for 1918 (60 per cent) was due to the acquisition of the South African gold mines, which passed to Britain as a result of the Boer war. In 1896, the South African production (even then 22 per cent of that of the world) is listed in the production of "other countries."

The results of the statistician, as above, interpret past events; the geologist-engineer may help in forecasting the future, and the different sources of knowledge combined may be illuminating as to present out-

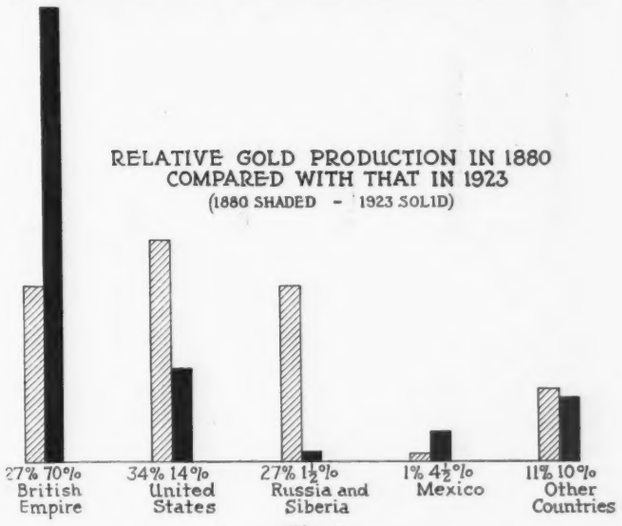

RELATIVE GOLD PRODUCTION IN 1880 COMPARED WITH THAT IN 1923
(1880 SHADED - 1923 SOLID)
27% 70% British Empire
34% 14% United States
27% 1½% Russia and Siberia
1% 4½% Mexico
11% 10% Other Countries

Fig. 2

look, conditions, and policy. As to the future, I must for lack of space content myself with stating baldly that in my opinion the relatively subordinate position which the United States has assumed since about 1890 will be permanent, and that it has resulted primarily from a thorough, aggressive, and scientific campaign of intensive exploitation. Great Britain passed the United States as the greatest gold-producing nation about 1896, when the Boer war of conquest annexed to the British crown the mines of the Transvaal, the richest "bed-rock" mines (a term opposed to the gravel mines, or "placers") of all time. Were it not for South Africa (including the Transvaal and Rhodesia), the British Empire in our 1918 figures above, for example, would have contributed only 14 per cent instead of 60, for South Africa alone contributed 46 per cent of the world's output. In that year British India produced about 3 per cent, Australasia 7 per cent, Canada 4 per cent. Of the total world production of about $384,500,000 in 1924, South Africa is estimated to have produced $210,000,000, or over 54 per cent! The Canadian production for 1924 is estimated at about $31,500,000, or 8 per cent of the world's production.

Of the chief factors which contribute to the British gold supply, Australasia appears to be about in the same boat with the United States, being a country where the cream of the gold resources, certainly, has been taken away. Barring the discovery of new and important fields, or government assistance, the production of Australasia is not expected to increase, any more than is that of the United States. British India has shown no increase in production for twenty years. The sources of supply are chiefly from one district—the Kolar field—and future increases are not to be predicted. The enormous 1924 gold output of the Rand,

in South Africa, comes from mines which have certainly long passed their zenith. They are mines largely working at depths of several thousand feet, having exhausted their more accessible ores. South African gold production has been immensely aided by the post-war depreciation of English currency, which has caused gold to be sold at a premium in London; and since labor and supplies have been paid for in the depreciated

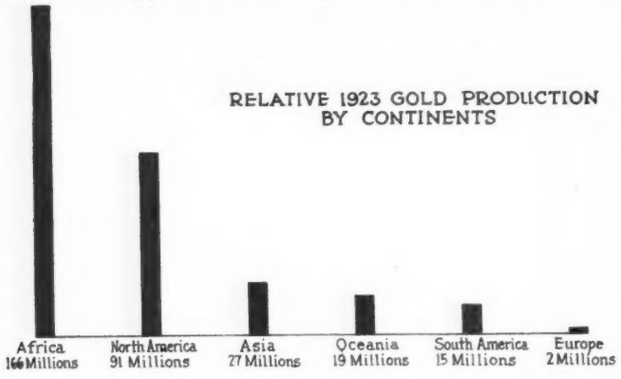


Fig. 3

English currency, the gold mines have had a substantial margin which has not been available to the miner in the United States, whose currency, being rated "on a gold basis," has been paid to the miner dollar for dollar—that is paper dollar for dollar of gold by weight brought in by the miner. But the South African miner who has brought in a gold pound has been receiving a pound and a fraction in British paper currency, depending upon the pound quotation in terms of dollars. With the return of the pound to a parity with the dollar, which is expected in 1925, this source of profit to the South African gold miner will disappear and its disappearance will be an adverse factor. Further economies and more scientific management may partially offset the disadvantages, but in the long run we can only expect the South African gold production to diminish. This leaves, of the important British sources, Canada, which may well maintain its present production or more for some years. Canada also, much more than Australia and the United States, has an excellent chance of discovering new gold-mining districts, for she has an immense unprospected territory. Barring the difficultly appraisable future of Canada, however, and even taking that into consideration, present vision must assume the decrease in the course of ten or twenty years, of the gold production of the British Empire also.

Prospective Sources of Production

As to other countries outside of the territories of the United States and Great Britain, I do not expect Mexico to develop gold sensationally in the future. Her heyday of gold production was when the El Oro district was in full blast, when the production, from 1908 to 1912, was over $20,000,000; but by 1918 it was less than $17,000,000, and in 1923 a little over $16,000,000.

South America has for a long time maintained a fairly steady output, principally from Brazil, Chile, Colombia, Peru, and Guiana. The total South American production was nearly $12,000,000 in 1912, was $14,000,000 in 1918, and $15,000,000 in 1923. Colombia, whose gold is mostly from placer sources (dredges), increased its output from nearly $3,000,000 in 1912 to $6,000,000 in 1918 and nearly as much in 1923. Altogether, the average of the South American production should be fairly well maintained for some time.

Siberia offers, perhaps, a source for future increase of gold production, in the light of our present knowledge. This region produced enormously and steadily for several decades up to the outbreak of the Great War, the production from 1880 to 1916 being between $20,000,000 and $30,000,000 annually. The war and the Soviet government reduced the output, so that it was only $1,000,000 in 1921 but rose to $5,000,000 in 1923 and in 1924. It is probably true that with a good government Siberia can resume its old status, and hold it for years.

Surveying the whole field, and with due humility in view of our incomplete knowledge, and taking account of possible and even probable surprises, it appears likely that the gold production of the world is, and has been for some years, in the neighborhood of its zenith; and even that the tendency henceforward will be to decline rather than increase. Mining is an act that can never be repeated twice in the same place; in which respect it is unlike all other industries. So that, looking forward with a long vision, we can at least see clearly that while the growth of population and industrialism will constantly create vaster and vaster amounts of commodities to be dealt in, through the world's currency mediums, the relative supply of gold whereupon to base this currency will grow progressively less and less. We appear to have reached the summit of the gold production hill, speaking generally and comparatively. We look forward and down; for while it is conceivable that the annual production may yet increase, it will not in the long run do so in proportion to the growth of wealth and trade.

Gold Stock Nine and One-half Billion

The gold stocks of the world, in the form of money and bullion, amounted at the end of the calendar year 1923 to $9,407,761,000—nine and a half billion in round terms, of which the United States held nearly one-half (over 47 per cent—$4,247,201,000). The rest is widely scattered, Great Britain having $759,174,000, or about 8 per cent; France $709,479,000, or some 7½ per cent; Germany $119,300,000, or somewhat over 1 per cent; Argentina $472,161,000, or over 5 per cent; Canada $227,964,000, or over 2 per cent; Italy $215,697,000, or 2 per cent; Netherlands $233,876,000, or over 2 per cent; Spain $487,687,000, or 5 per cent; Switzerland $142,269,000, or 1½ per cent; and so on. Taking the principal components of the British Empire—or Commonwealth of Nations, as it is more recently called—Great Britain, Ireland, India, Canada, South Africa, and Australia—there was a total monetary gold stock of $1,432,760,000.

The real soundness of a country's currency, of course, depends not so much on the gold stocks relative to the rest of the world, as the gold stocks per unit of population. Thus at the end of 1923, the per-capita monetary gold stocks of the countries mentioned were: Argentina, $54; Australia, $39; United States, $38; Switzerland $36; Netherlands, $33; Canada, $25; Spain, $23; France, $18; Great Britain, $16; South Africa, $8; Italy, $5, and Germany, $2. The per-capita gold supply of the principal components of the British Commonwealth, above noted, was about $3½; or, if we eliminate British India, to make a fairer comparison, nearly $18.

And the instance of British India shows that the per-capita comparison is only relative between peoples of equal industrial development, activity, and trading wealth, for the per-capita gold reserve of 36c. per capita for the three hundred million people of India certainly does not impair the standing of Great Britain and the Dominions. Or, to state it in another way, the need for money—that is to say, gold—is in proportion to the amount of commodities handled, a factor which varies enormously, with the per-capita productivity of individuals and nations, and with the activity of trade; and also varies immensely at different stages of the world's industrial evolution. Since the productivity of the average individual in progressive nations has been enormously increased by mechanical devices in the last century, beginning with the steamboat and railroad, and leading up through the marvelous accumulation of machines and mechanical and social devices which save the individual's time and multiply his output manifold, such nations will need a larger per-capita supply of money to effect the distribution of these commodities.

Flow of Gold to the United States

There is no better illustration of this thesis than the United States, which showed a gradual increase in per-capita gold stock, ranging from around $3 in the early 70's (1873-76) to between $18 and $19 in the period 1908-13, the so-called last normal pre-war period. Due to unsettled world conditions it reached in 1924 nearly $40 per capita, as against $19 in 1913. Had it not been for the Great War, the pre-war curve indicates that the 1925 gold per capita would naturally have been around

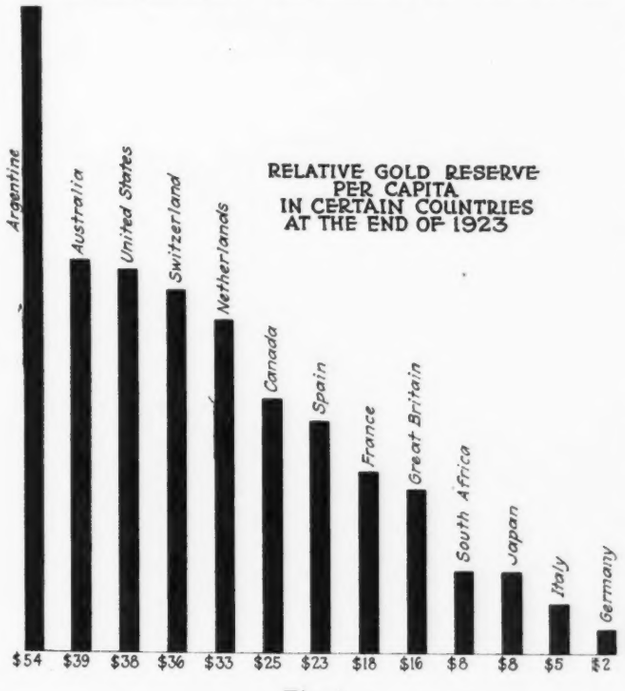


Fig. 4

$24 or $25, with a normal gold reserve of about $2,800,000,000, as against the present stock of $4,490,807,000, brought on by the industrial war-anaemia of Europe. But this figure of $2,800,000,000 is nearly a round billion greater than the gold stocks of 1913; and if industrial development and population grow—as both are doing—the United States in ten or twelve years should really need for the proper transaction of its business on a gold basis as much gold reserve as it now somewhat unnecessarily and temporarily holds. And by the same reasoning, at the close of 1923, on the above assumed desirable basis of $25 gold per capita, Great Britain and her dominions of Ireland, Canada, South Africa, and Australia should have had a reserve of nearly $2,000,000,000 or over $500,000,000 more than was actually at hand. In addition, Continental Europe (even excluding Russia and Turkey), for its three hundred million of population, even at $20 per capita, should need $6,000,000,000 gold reserve, instead of the somewhat over $2,000,000,000 ($2,200,000,000) which it now holds or held at the close of 1923. It would therefore appear that at the close of 1923, North America (excluding Mexico) and Europe (excluding Russia and Turkey), together with South Africa and Australasia, should have had a gold reserve of over $10,500,000,000; but there existed only $9,500,000,000 in the world, so that the needs of all Asia and all the rest of the world are not taken in consideration. Japan's gold stock at the end of 1923 was $602,188,000, or $7.66 per capita.

Altogether it would seem that instead of there being too much gold in the world in comparison with conditions twenty, forty, sixty years ago, there is too little, in spite of the great increment of world gold stocks and production since 1890.

Relation of Gold Stocks to Cost of Living

It is a frequently expressed theory that the tendency toward higher prices for commodities, resulting in the general increase in the cost of living and in the wage scale, is the result of the flow of gold which began around 1850 and was turned into a veritable flood around 1900. Van Hise, for example, ("Conservation of Natural Resources," Macmillan, 1910), observes that during the twelve years 1896-1907 the world produced more than 50 per cent of the amount of gold existing at the end of that period. "During those twelve years the prices for all other commodities have increased on the average 50 per cent. The connection between the two is obvious. Gold has depreciated in value during those twelve years." But further examination shows stronger arguments on the other side. To be sure, the U. S. Bureau of Labor wholesale commodity price index number for 1896 was 67, and for 1907, 94, an increase of nearly 50 per cent. But in 1911 the price index was only 93; while in 1881 and 1883 it was also 93; as it was indeed in 1851. When we study the price index numbers from 1840 to the present time, we are astounded to be unable to find any symptom of influence of the "flood of gold" upon them. From 1850 to 1861, during the period when the world's annual gold production rose to an annual average of over $133,000,000 as compared with an annual average of $36,000,000 in the decade previous, the average price index had a net fall, starting at 90 in 1850, rising to 99 in the years 1854-57, then declining to 88 in the three years 1859-61.

The Civil War brought on inflation and high prices; so that the price index rose to 190 in 1865 and remained above 100 till 1877, fifteen years after it had crossed that mark in 1862. In 1878 it dropped to 89, and, with vicissitudes, gradually worked down from 87 in 1884 to 80 in 1891. During this period the world's annual production remained fairly constant at well over $100,000,000 on the average. From 1891 the price index sank gradually to 67 in 1896-97, the lowest

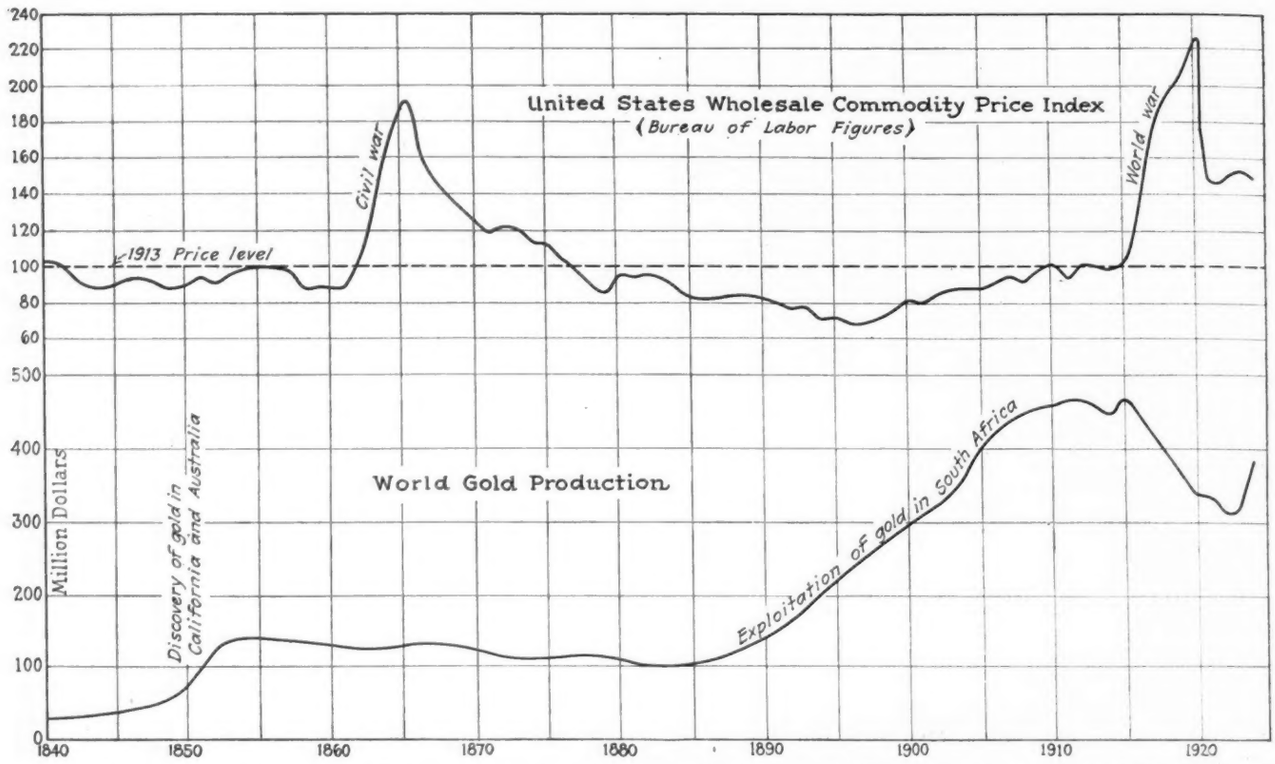


Fig. 5—Curves showing relation of world gold production to commodity prices in the United States

figure since 1840, and one which must be considered abnormal. During the period 1891-97, the world's gold production grew by leaps and bounds, from $130,000,000 in 1891 to $236,000,000 in 1907. From 1897 there was, to be sure, a gradual increase in the price index, but only a return to what seems to be near the norm—to 100 in 1913 (the year taken as the standard of comparison), and 98 in 1914. The average price index for the five years 1911-15 is 98, which is below the periods 1840-41 and 1854-57. Indeed, when we study the course of prices since 1840, we are impressed first with the well-recognized fact that the great cause for increase in commodity price is war, and that in proportion to the severity of the war; 1840-41—Mexican war—102½ average; 1862-76—Civil War—an average of 133; and 1915-1922—Great War—(period still incomplete) 166 for the eight years.

In the spaces intervening between wars, the twenty years 1842-1861 show an average price index of 92; the thirty-eight years 1877-1914 an average of 85: the annual average for these two peaceful periods, aggregating fifty-eight years, being about 88. Comparing the average index of 92 for the period 1842-61, however, with that of 85 for 1877-1914, there are certainly no evidences of the flood of gold having caused higher commodity prices. The average for the ten years 1901-1910 was 89. In the two decades 1842-61, the world production of gold was $1,696,909,000; in the thirty-eight years 1877-1914 it was $9,227,546,000: an annual average of $84,845,000 for the former period and of $242,830,000 for the second period.

Indeed, what seems to be indicated is a rather nice running balance between current supplies of gold and current supplies of commodities; and we must conclude that had it not been for the enormous flood of gold, the prices of the growing flood of commodities which have characterized the period since 1840 would have declined very strikingly—in other words, that the best the gold miners have been able to do is to keep pace with the increasing annual output of commodities. As an example of this, compare the rough table, on the next page, of United States production at intervals selected at random.

Recent Great Increase in Consumption of Metals

In 1900, as compared with 1850, the United States gold production was 58 per cent greater, world gold production was about four times greater, the United States gold reserves were about five times greater; the United States production of wheat was five times greater; of copper 416 times greater; of pig iron 24 times greater. These figures are striking commentaries on the fact that while with increasing industrial civilization and wealth the individual cannot consume much more wheat, his consumption of other things, such as copper and iron, has no visible limits. The increase in wheat production is more nearly commensurate with the increase in population, which increased nearly 3½ times between 1850 and 1900; but the increases in copper and pig iron production are many times the increase in population. Even allowing for the export business which was built up in all these commodities, the fact remains that the consumption of copper and iron per capita has enormously increased, an increase which is represented by steamboats, railroads, automobiles, plumbing, telegraph, and telephone and the like.

According to all that we have considered, the great and permanent increase in the gold production of the United States and the world, which began with the discovery of California gold in 1848, appears to have been timed so as to opportunely finance the great increase of commodities which arose about this time through the development of mechanical devices, which had been growing since the early part of the nineteenth

century. The total gold production of the world between 1841 and 1850—ten years—was about $364,000,000, and of the United States for that period $106,000,000 (of which $100,000,000 was produced in California in 1848-50); the average price index for these years was 92. Between 1851 and 1860—ten years—the total world gold production was $1,333,000,000 and of the United States $561,000,000; and the average price index for that period was 94. In the two decades 1891 to 1910, the annual world gold production gradually climbed from about $135,000,000 to about $460,000,000, a total of $2,101,000,000 in the first decade, and $3,781,000,000 in the second; for the first decade the price index averaged 73, for the second 89, for the whole twenty years, 81. Those figures indicate that had it not been for the two floods of gold, the first of which began in 1848 and the second and larger of which ran from 1891 to 1910, the amount of gold in the world would have been far too little for the increased volume of commodities to be bought and sold through it, and prices of commodities would have fallen greatly. As it was, the average price index of 73 for the decade 1891-1900, during the flood of gold ($2,101,000,000), is to be compared with the figure of 86 for the preceding decade, 1881-1890, when the total world gold production was $1,060,000,000, or just half that of the next decade.

Great War Affected Production Factors Dissimilarly

Since the Great War, gold production in the United States has been unfavorably affected by the high commodity price level, which means relatively high cost of mining, while the price of the product remains fixed. South Africa and British India, and to some extent Canada, on the other hand, have profited by the depreciation of the pound sterling, for their costs have been in depreciated currency, while they have marketed their gold at par. Until the period of post-war adjustment clears away, therefore, gold mining will also be busy adjusting itself. War brings high prices largely because it diminishes the supply of commodities in relation to the demand, since men leave constructive work and use their energy in destruction; and the time it takes to return to normal economic peace conditions depends upon the amount of construction lost and of destruction wrought. The adjustment took ten years after the Civil War; adjustment is still in progress now, six years after the Great War.

Supply and Consumption Have Decreased

The world supply and consumption of commodities relative to the available gold have decreased since pre-war times, and this is one of the chief factors why commodities are still high in price. If average peace and prosperity abide with the world in the next few decades, we can foresee a great increase in the production and consumption of commodities in general; but for gold, as above stated, we cannot see any commensurate increase. The indications are that the production trends of gold and of commodities in general will become more and more divergent as time flies, and it is very possible that the world will never again see so large a production of gold relative to the production of other commodities as marked the period from 1898 to 1915. In the long run, therefore, the world commodity price index should tend to sag. As it does so, the cost of gold mining will be lessened, and this will tend to increase gold mining and production, and thus offset the secular decline. Another offset to this secular decline will be constantly greater efficiency and economy in operating mines. These checks will flatten out the general declining tendency; but they cannot obviate the progressive exhaustion of gold mines, while the increase of general commodity production will rise without any visible limit.

Loss of Gold Used in Arts

Another factor to be considered, which will tend to accelerate the future increasing relative shortage of gold money, is the use of gold in the arts, whereby much of it is lost. As observed in a preceding paragraph, only about half of the recorded gold produced now remains in the treasuries of the world. The world's average consumption of gold in the arts, including jewelry, was estimated in 1922 by Samuel Montagu & Co., of London, at $100,000,000 per annum. But the report of the Director of the United States Mint for 1923 shows that during that year the amount of gold used in the arts in the United States was $69,000,000, of which $40,000,000 was virgin metal. Since the total production of the United States in 1923 was $50,000,000 ($52,000,000 in 1924), only $10,000,000 remained to swell the world's gold reserves.

With the increasing relative scarcity of gold as compared with money requirements, the general tendency will also be toward a smaller gold basis or "cover" for currency, even among those nations which are "on a gold basis." More and more the possession of gold reserves will be a matter of export balances; that is to say, a matter of competition in productivity and economy among nations. World trade will tend to distribute the abnormal gold reserves of the United States among the other highly progressive nations. Meanwhile the British Empire will be in an especially favorable position, through its great gold production, for years; just as the position of the United States in that respect will be definitely unfavorable. Recently Mexico has profited through being a gold-producing country, by taking steps to retain her mined gold to build up her monetary gold reserve.

Production of Various Commodities, United States Gold Reserve and Population, and Commodity Index, 1850-1923

	(United States)							
Year	Gold Dollars (000 Omitted)	Copper, Thousands of Pounds	Wheat, Thousands of Bushels	Pig Iron, Thousands of Long Tons	U. S. Gold Reserve Coin and Bullion, Millions of Dollars	World Gold Production, Thousands of Oz.	Commodity Price Index Figure U. S. (Referred to 1913)	Population of United States, Millions
1850	50,000	1,456	100,486	564		3,310(a)	90	23
1860	46,000	16,128	173,105	821	214	6,486	88	31
1870	50,000	28,224	235,885	1,665	189	6,270	125	38
1880	36,000	60,480	498,550	3,825	352	5,149	94	50
1890	32,845	259,763	399,262	9,203	696	5,749	81	63
1900	79,171	606,117	522,229	13,789	1,034	12,315	81	76
1910	96,269	1,080,159	635,121	27,304	1,635	22,022	101	92
1920	51,187	1,209,060	833,027	35,710	2,708	16,302	226	106
1923	51,734	1,435,000	785,741	38,364	4,050	17,751		111

(a) Average of 15 years.

Bauxite Deposits of British Guiana

One of the World's Most Important Known Sources of Aluminum Ore

By Lloyd T. Emory
Consulting Engineer, 4 South 15th St., Philadelphia

Three Friends bauxite mine, a working face of ore

BRITISH GUIANA is one of the three small colonies on the northeast coast of South America, controlled by European powers. Its area is approximately 90,000 square miles, with a population of about 300,000, made up of Anglo-Saxon whites, Portuguese, Chinese, East Indians, aboriginal Indians, negroes, and half breeds, the latter composed of a mixture of any two and sometimes all of the straight strains.

The colony is divided into three counties, Berbice, Demerara, and Essequibo, and the Northwest, Pomeroon, and Rupununi districts. As the only "Port of Entry," where ocean-going steamers can enter a harbor, is Georgetown (population 60,000), the whole country is usually spoken of in commercial and shipping circles as Demerara. Several lines of steamers from English ports touch at Georgetown, and two lines from New York and one line from Halifax. It is a fourteen-day trip from New York, and three weeks from England.

From a topographical standpoint the country is divided into three well-defined areas, a coastal plain, a badly broken semi-mountainous belt of foothills, and an interior plateau region.

The coastal plain extends inland for 30 or 40 miles from the beach line. Mud flats extend 8 or 10 miles seaward. A large part of the area back of the beach line, where sugar and rice are grown, has to be diked to keep out sea water, as it is below the level of high tide. The principal towns and probably 80 per cent of the population are located on the coastal area.

Back of the coastal plain is a forest belt of badly broken jungle-covered foothills, which in places assume the proportion of mountains. The country rock is traversed by numerous dikes and igneous intrusions. In this area the large rivers, of which there are five—Cuyuni, Mazaruni, Essequibo, Demerara, and Berbice—and numerous smaller ones, in their descent from the back country plunge down a series of falls and cataracts which make navigation impossible for any but small boats that can be hauled up the rapids and around the falls by hand. However discouraging these falls may be to present-day travelers, at some time in the future they will furnish almost unlimited power for hydroelectric development. The Kaieteur Falls, on the Potaro River, about 150 miles inland from Georgetown, have a vertical drop of 741 ft., nearly four times as high as Niagara. They are an undeveloped possibility that could be converted into an enormous power station of a 1,000,000 hp.

It is from the foothill area that most of the mineral production of the colony is obtained. In 1923, 7,262 oz. of gold and 214,744 carats of diamonds were entered at the office of the Commissioner of Lands and Mines. Iron, manganese, and mica have been reported.

Beyond the forest belt is a plateau composed of grass-covered savannahs, traversed by numerous rivers with wooded banks and broken here and there by mountains that rise singly or in groups, as Mount Roraima (elevation 8,635 ft.) and the Kanuku Mountains. A number of ranchers have settled in this hinterland, but the difficulty of getting in supplies and getting out their cattle is holding up development until some enterprising capitalist builds a railway in from the coast.

Bauxite is a hydrated oxide of alumina, having the formula $Al_2O_3 . 2H_2O$. Commercial ore is often a combination of gibbsite, bauxite, and diaspore, the three oxides of alumina, with silica, iron, and titanium as impurities. It is the principal ore from which the metal aluminum is derived and is also used in the chemical industries and for the manufacture of abrasives, refractory brick, and cement.

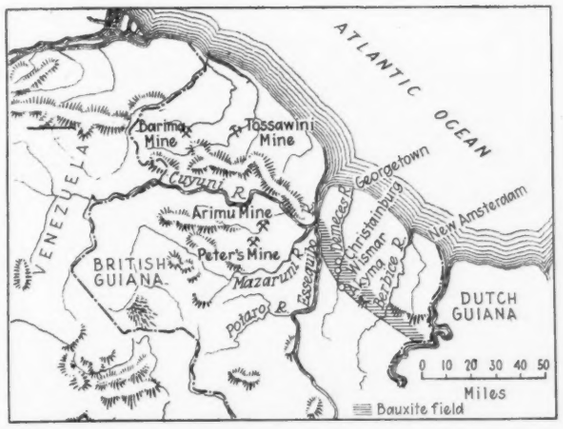
As is often the case, a mineral may be known, kicked about, and used for many purposes for which it was never intended until someone comes along who knows its true value and market possibilities. Over a hundred years ago Dutch planters sent their boats up the Demerara River to obtain stone for building and sugar-mill foundations. As the bauxite was the first rock encountered in going up the Demerara River, and as it was easy to quarry, it was naturally used, although its strength and lasting qualities were not of the best. These old walls on abandoned plantations in the coastal area, overgrown with tropical vegetation, have proved to be the source of many reported discoveries of ore in the last few years. On going back through the government reports, one may note the following references:

C. Barrington Brown, Government Geologist, wrote in 1873:

> "Not far from the Demerara River the land rises, and the subsoil is of a whitish clay, with numerous blocks of iron-cemented sand on top and lumps of a reddish white friable pisolitic rock." (Geology of British Guiana," p. 247).

Sir John B. Harrison, Director of Science and Agriculture, one of the most interesting scientific men I have ever met, and one who seems always willing to give his valuable time to those who visit his laboratory in search of information, published a memorandum dated Sept. 1, 1914:

> "I examined the deposits in question at Akyma and Christianburg in January, 1897. At that time I was interested in searching for phosphate of alumina similar to Connatable Island (French Guiana) phosphates. I collected samples, which are in the museum of this department. Towards the end of that month, I showed Dr. (now Sir Daniel) Morris the deposits at Christianburg. . . . Further samples were collected by me at Akyma in November, 1898. The samples were examined and proved not to contain phosphoric acid, but to be rich in aluminium hydrate. The Christianburg deposit was re-examined in May, 1906, by the Honorable A. G. Bell and myself, and a large sample was collected for analysis. . . ."



Map of British Guiana showing location of bauxite field

In a report by Sir John on the Demerara River deposits, published in the *Official Gazette* (British Guiana), July 16, 1910, appears the following interesting paragraph:

"I have the honor to report for the information of the Governor that I have examined speciments of rocks obtained from the low hills at Christianburg and at Akyma, Demerara River, and have found them to largely consist of free alumina, 64 to 66 per cent in the state of hydrate. A specimen obtained from a shoal in the bed of the Demerara River at a distance of about half a mile above Christianburg was found to be of similar nature and to contain over 42 per cent of free alumina in the form of hydrate.

"The specimens examined are typical examples of cream-colored laterite which resembles in properties and composition the laterite nodules from the Central Provinces of India described in *Bulletin* of the Imperial Institute.

"At the present probably these deposits are of too low commercial value to warrant their exploitation for export as sources of alumina, but their exceptional purity renders it desirable for their occurrence to be placed on record."

From a paper by the same author, published in the Geological Magazine (London) October, 1910, page 449, comes the following paragraph:

"At Christianburg, on the Demerara River, about 58 miles south of Georgetown, where the government has a Para rubber experiment station, the surface of the low hills is a sandy soil which rests on beds of cream-colored, reddish-gray, or red highly aluminous laterite or bauxite. . . . At Christianburg the bauxite apparently is underlain by a pale buff-colored Arenaceous clay."

Another report by Sir John under date of July 14, 1913, contains more detailed information on the same subject.

However, as in other countries, valuable information has been buried in government reports for years without exciting any comment, until some circumstance often entirely beside the point brings it to notice. In 1910 a civil engineer, the late Francis G. Harvey, while looking for stone with which to pave the streets of Georgetown, examined the deposits near Akyma. Mr. Harvey sent some of the material down to Georgetown and it was tried out as a binder to hold the harder rock used in surfacing the streets.

Early in 1913 Mr. Harvey went to England to dispose of several mining properties in which he and the late Evan Wong were interested, and he took with him a sample of bauxite. After trying to interest the British Aluminum Company in his bauxite properties, he went to see the late Edward C. Darling, then representing the Northern Aluminum Company of Canada, a subsidiary of the Aluminum Company of America, in the Canadian company's London office. Mr. Darling took an option on Harvey's holdings, and sent the samples to Pittsburgh.

One of the engineers of the Aluminum company at once left for Demerara. His visit was more or less a preliminary one to investigate conditions. After looking over the ground he realized it would take months to purchase all the properties available, and so left without making any acquisitions. On his return to the United States the late George B. MacKenzie was dispatched to Demerara as a representative of the Republic Mining & Manufacturing Co., of Philadelphia, a subsidiary of the Aluminum Company of America, to stay on the job until all the workable deposits had been optioned or acquired. Mr. MacKenzie arrived in Demerara early in 1914, and entered into an agreement with the late Evan Wong regarding his share of the Harvey-Wong holdings. In the meantime the option from Harvey to Darling had expired and Mr. Harvey made an agreement with the Merrimac Chemical Co., of Boston, who dispatched Donald F. Campbell to Demerara. The usual scramble for properties followed, resulting in legal controversies the history of which would fill a volume. Eventually the government told contesting parties that they would have to get together or they would all receive nothing. An agreement was concluded by which the Merrimac Chemical Co. dropped out and several leases were signed by the government with the Northern Aluminum Company of Canada. Mr. MacKenzie had in the meantime acquired a large acreage of private property, old plantations that were held by "Boveanders," the decendants of the Dutch settlers.

In September, 1916, the Demerara Bauxite Co., Ltd., was incorporated locally to take over and operate the properties and leases that had been acquired through various sources by those interested for the Aluminum Company of America. Actual development work was started in December of that year and several shipments of ore were made early in 1917.

The area known to contain bauxite extended along the edge of the foothills where they join the coastal plain, from near the mouth of the Essequibo River to a point on the Courantyne about 75 miles up from where it enters the sea. It is doubtful if the deposits were ever continuous. If they were at the time of their formation, they are not at present, as the erosion of the larger streams has cut below the ore horizon. Between the principal rivers the land rises to an elevation of several hundred feet above the ore, so even if deposits do exist under this heavy overburden, it is doubtful if from a commercial standpoint they are of importance.

Power plant of Demerara company's drying and crushing plant at Mackenzie

Overburden being removed at outcrop of Demerara Bauxite Co.'s Three Friends mine

It is therefore along the slopes of the valleys of the larger streams where the ore outcrops that it is at present available. The fact that the ore is very much harder and more resistant to weathering than either the overburden, which is white quartz sand, or the underlying formation, which is composed of stained and mottled kaolin, makes the orebodies stand out prominently. In some cases the outcrops appear as vertical bluffs, the tops of which often extend back for considerable distance, with little or no overburden.

The slopes below these bluffs are covered with boulders of broken ore and fines, which at first gives the impression that the orebody is of great thickness. As a matter of fact, 25 ft. seems to be about the maximum. The average runs quite uniformly between 16 and 20. Owing to local erosion and redeposition, secondary deposits have been formed of varying thickness and extent. In some cases, as at the Three Friends property, isolated hills have been preserved by their capping of ore and are ideal for working, as they have little or no overburden beyond pebble ore, loam, and a tangle of roots, and are well up above the water level. These conditions also facilitate the dumping of waste and the transporting of the ore to the river or main line of track.

The type or general form of ore is pink or light salmon in color, although variations extend from a cream white to a deep red, owing to different iron contents. The "type form" very closely resembles the sponge-like structure of pumice, and can be whittled with a knife, but chunks of ore are quite resistant to being broken with a hammer. The material crushes locally under a hammer blow, but is hard to split. This quality adds to the difficulty of both sledging and blasting.

On weathering, a portion of the alumina is removed from the surface, thus increasing the iron content and forming a hard, reddish capping which gives the exposed faces the typical appearance of laterite. The pisolitic structure so characteristic of American bauxites seems to be totally absent in the main orebodies, but has been noted in some of the bodies of bauxite clays along the upper or inland edge of the ore field. These clay deposits are probably residual and have been formed by the weathering of feldspatic rocks *in situ*.

Light overburden being removed by hand at Three Friends mine

As in all ore fields, the chemical composition varies in different parts, and from top to bottom of the orebody. Iron, silica, and titanium are the principal impurities, but unlike most bauxite deposits there are enormous bodies that are so uniform in chemical composition and so low in both iron and silica that little or no hand sorting of the ore is required, and a steam shovel can be employed in handling it. In the following table the analyses in the first two columns are taken from a government report, and appear to have been hand-picked. The third column is the average of analysis of samples from ten test pits, the sample material being taken from top to bottom of the orebody, including all material that in mining would be considered as commercial ore.

Mine laborers' camp at Akyma

Analyses of Bauxite Samples

	Christianburg	Akyma	Average of Ten Test Pits
Alumina Oxide	67.28	64.86	61.95
Silica	2.85	2.71	1.82
Iron Peroxide	1.53	.85	2.41
Titanium Oxide	1.07	.75	2.86
Magnesium Oxide	.07	.31	.....
Combined Water	27.46	30.47	30.35
Totals	100.26	99.95	99.39

Owing to the accessibility of the Demerara River valley and the fact that the ore exposures indicated vast quantities of high-grade ore, the scramble for ore rights soon exhausted the supply of available ore land, both private and belonging to the Crown. The Demerara Bauxite Co., Ltd., owns or controls probably 90 per cent of the ore, and the remaining 10 per cent is tied up in one way or another so it is not available for purchase. The properties of the company extend from Christianburg south on both banks of the river up stream for a distance of about 15 miles.

The Demerara River is navigable for ocean-going ships not drawing over 16 ft. of water from its mouth to a point about a mile above Christianburg, where a rock reef interrupts the channel, above which the river shoals to 5 or 6 ft., with a hard sandy bottom.

Early in 1917 the Demerara company established two camps from which to begin operations, one at the head of ship navigation, which has since been named MacKenzie, and another 12 miles up stream at Akyma, near

Demerara Bauxite Co.'s camp at Akyma. Club house and laboratory in foreground

where mining operations were started on the Three Friends property. The tropical bush had to be cut before the first shelters could be built, and almost a year was spent in what might be termed pioneer work, including surveying, test-pitting, and preparing the way for permanent construction. The fact that no serious epidemics of disease occurred during this period, when more than 1,400 laborers had to be provided for, is to the credit of the company, which furnished the means, and to the engineers in charge of the work, who took every precaution to eliminate flies and mosquitoes, and furnished the men with suitable food and potable drinking water. Palm-thatched huts were the first shelters, which were followed by shacks built of imported lumber, until a sawmill could be erected at Mackenzie.

Though the country above Christianburg and Wismar has been sparsely settled for a great many years by "Boveanders" descended from the old Dutch and aboriginal Indians, it is on the edge of the uninhabited jungle, and it was not unusual the first year to have game stray into camp. A 200-lb. jaguar was killed robbing a pig sty at Akyma and a 21-ft. water python was found in the river near Mackenzie. Parrots and macaws could be heard almost any time, and tribes of monkeys frequently visited the treetops near the river.

The first ore shipped was brought down from Three Friends in fifty-ton punts or barges and loaded on steamers lying in the stream. A standard-gage railway has since been built along the east bank of the river from Three Friends to the crushing and drying plant at Mackenzie. This plant when in full operation should have an ore-handling capacity of about 300,000 tons per annum. The Mackenzie plant also has a large storage shed for dry ore, connected to the dock by a belt conveyor, so that the ships can be loaded out in minimum time after their arrival.

At present the overburden at the Three Friends mine is being removed by steam shovel, as the easily accessible ore has been worked out. The ore after being blasted is loaded by a steam shovel into standard-gage dump cars, which are hauled by locomotive to the Mackenzie plant. It may be found later that some form of hydraulicking will be the most economical method of handling the overburden.

At the close of the war the company launched two steamers, the "George B. Mackenzie" and the "John R. Gibbons," having a cargo capacity of about 3,000 tons each, which have been operated under the name of the Aluminum Line. Chartered bottoms are also carrying ore for the company to New Orleans and Atlantic ports.

The following table gives the yearly export since the starting of operations to date:

Year	Long Tons	Year	Long Tons
1917	2,037	1921	19,694
1918	4,199	1922	none
1919	1,967	1923	100,346
1920	22,084	1924	154,324

All the private property known to contain bauxite in commercial quantities has been purchased by people directly interested in industry. Since the granting of several concessions to the promoters of the Demerara company, both the Colonial Office in London and the Land and Mines Department in British Guiana have refused to grant any more concessions. In spite of the government warning to the effect that "The subject of Bauxite mining in this colony is engaging the attention of the Imperial Government, and all applicants are informed by direction of the Secretary of State for the Colonies that no concessions for mining bauxite will be made or promised until after the war, when the whole question will be considered in connection with the subjects of imperial trade and defense," four hundred applications were filed in the Department of Lands and Mines, covering about 652,940 acres of Crown lands, during the year 1917.

Most of these applications were filed by speculators who knew nothing about bauxite and were scattered pretty much all over the colony, wherever Crown land remained unoccupied. Though the department promised nothing, it required a filing fee of $10 for each 1,000 acres for which application was made. Twenty additional applications were filed in 1918, and thirty-six in 1919. In September, 1921, all applicants were notified that their filing fees would be returned in full on application, and before the end of the year $16,606 had been refunded. During the same year a syndicate headed by the British Aluminum Co., Ltd., was formed to take over from the government the remaining areas of Crown land known to contain bauxite in commercial quantities. These negotiations are still in progress, and until they are concluded it is hardly likely any new applications or offers will be considered.

The last official statement regarding bauxite is contained in the annual report of the Lands and Mines Department for 1923, which was published several months ago, and reads as follows:

"No regulations have been approved by the Secretary of State for the Colonies as yet for the exploration or working of bauxite deposits and no new titles were issued during the year."

Determination of Xanthate in Impure Solutions

By A. F. Hallett and Frank Ryder

Chief Chemist and First Assistant Chemist, Inspiration Consolidated Copper Co.

THE SOLUTION whose analysis is to be discussed is a dark brownish-red liquid with a specific gravity of 1.212. It is the mother liquor produced during the manufacture of potassium xanthate by the alcoholic process, and is used as a flotation reagent.

In making this analysis three methods have been tried, all of which have been found to be of uncertain value. These methods are (a) the volumetric method using $\frac{N}{10}$ hydrochloric acid with methyl red indicator, (b) the direct precipitation of the xanthate with copper sulphate, and (c) the determination of the sulphur present, which is calculated to potassium xanthate.

(a) It is impossible to use a volumetric method, because the red solution masks the color of the indicator (methyl orange or methyl red), obscuring the end point.

(b) In determining potassium xanthate by precipitating with copper sulphate solution, the presence of carbonates, sulphides, and thiocarbonates will cause high results, as these compounds all precipitate copper from the copper sulphate solution in addition to that precipitated by the potassium xanthate.

(c) In the same way any method which determines the sulphur and calculates the potassium xanthate from it gives high results, as the sulphur in the potassium xanthate and that in the other sulphides present cannot be separated, but would be determined together.

The following method will determine potassium xanthate accurately in the presence of carbonates, sulphides, thiocarbonates, and carbon bisulphide, all of which are present in the solutions as impurities. The sulphides and thiocarbonates are removed and in the precipitation of the copper xanthate the carbonates and carbon bisulphide will not interfere. It depends on the fact that sulphides and thiocarbonates can be precipitated by an ammoniacal solution of zinc chloride and removed from the solution by filtering.

$$K_2S + Zn\,Cl_2 = Zn\,S + 2\,K\,Cl$$
$$K_2CS_3 + Zn\,Cl_2 = Zn\,S + 2\,K\,Cl + CS_2$$

The potassium xanthate in the filtrate can be precipitated by a copper sulphate-sodium tartrate solution and separated from the carbonates and carbon bisulphide by filtering.

$$2\,KCS_2\,(C_2H_5O) + Cu\,SO_4 = Cu\,(CS_2 \cdot C_2H_5O)_2 + K_2\,SO_4$$

To prove that a solution of ammoniacal zinc chloride will remove the sulphides and thiocarbonates, various samples of impure solutions were tested for these impurities before treatment with the ammoniacal zinc chloride. They were always found present in large amounts. After the precipitate produced by the ammoniacal zinc chloride had been filtered off, the filtrate was tested for sulphides and thiocarbonates; these were always found absent, indicating complete removal of sulphides and thiocarbonates. Further tests on pure potassium xanthate dissolved in water and treated with ammoniacal zinc chloride show that potassium xanthate is not affected by this reagent. Therefore, it can be assumed that the potassium xanthate in these solutions is not affected or precipitated by the ammoniacal zinc chloride and that the removal of the sulphides and thiocarbonates is exact and complete. That this operation is not variable, but is always complete, is further shown by the fact that duplicate assays checked each other within the limits of working error, and often exactly.

The tests used for sulphides and thiocarbonates are those contained in the article on "The Analysis of Xanthate," by Calcott, English, and Downing (*Mining Journal-Press*, Dec. 20, 1924). The method to be outlined is supplementary to the one there given.

Determine the specific gravity and temperature of the solution to be analyzed. (That the results obtained from day to day shall be comparative, the solutions must be at the same temperature. In our laboratory, 27 deg. C. is taken as the standard.)

Measure 10 c.c. of the solution and place in a 250-c.c. volumetric flask. Make up to the mark with cold distilled water and mix well by shaking. Place 25 c.c. of this solution in a 250-c.c. beaker and add 25 c.c. of distilled water. Add enough ammoniacal zinc chloride solution to precipitate the sulphides and thiocarbonates. About 10 to 15 c.c. of a 10 per cent solution, strongly ammoniacal, will be required. Place on the steam plate and warm five to ten minutes until the color changes from yellow to cream white, showing that the precipitation of the sulphides is complete. When it has settled fairly clear, filter and wash five times with dilute ammonia. To the filtrate (which should be about 300 c.c.) in a 500-c.c. Erlenmeyer flask, add 25 c.c. of a copper sulphate-sodium tartrate solution. (The copper sulphate-sodium tartrate solution is made by dissolving 25 gm. of $CuSO_4 \cdot 5H_2O$ in 600 c.c. of hot distilled water. Cool to room temperature and add 200 gm. of c.p. sodium tartrate. After complete solution of the tartrate, slowly add 10 per cent Na_2CO_3 solution until the color of the reagent turns to dark blue and the reagent is just alkaline to litmus, indicating an excess of Na_2CO_3. Then dilute the solution to a volume of one liter and filter. This solution is the one used by the du Pont company.) At this point it should be at approximately room temperature or slightly above.

Place in a pan of cracked ice and water for one to three hours, with occasional agitation. Filter and wash with cold water until precipitate is free from copper sulphate. Ignite the precipitate of copper xanthate and place it, when cool, in a 300-c.c. electrolytic beaker. Add 5 c.c. HNO_3 and dilute to 25 c.c. Make it slightly ammoniacal, neutralize with HNO_3, and add 4 c.c. excess. Add 3 c.c. H_2SO_4, dilute to 150 c.c., and electrolyze for forty minutes, using a rotating anode with 2 amperes and 125 volts for fifteen minutes and raising this to 4 amperes for the last twenty-five minutes.

From the weight of copper obtained, the potassium xanthate in the sample taken can be calculated as follows:

Weight of copper = 0.0520 gm.

If 1 c.c. of the solution is taken and the specific gravity is 1.212, then

$$\frac{0.0520 \times 5.04}{1.212} \times 100 = 21.62 \text{ per cent potassium xanthate.}$$

The factor 5.04 is obtained as follows:

$$2\,KCS_2\,(C_2H_5O) + Cu\,SO_4 = Cu\,(CS_2 \cdot C_2H_5O)_2 + K_2SO_4$$

1 copper (63.5) reacts with 2 potassium xanthate (320.2)

$$\frac{320.2}{63.5} = 5.04$$

The following table shows the percentage of potassium xanthate before and after removal of the impurities in various impure solutions:

Sample Number	False Potassium Xanthate—Sulphides and Thiocarbonates Present: Potassium Xanthate, Per Cent	Specific Gravity	True Potassium Xanthate—Sulphides and Thiocarbonates Removed: Potassium Xanthate Per Cent
A	34.5 34.3	1.206	22.5 22.3
B	40.4 40.6	1.212	16.3 16.2
C	42.7 42.4	1.206	33.1 32.9
D	45.9 45.9	1.202	21.4 21.4
E	44.0 43.7	1.213	33.6 33.9
F	40.1 40.1	1.195	31.8 32.0
G	45.8 45.9	1.212	37.4 37.4
H	48.6 48.4	1.232	38.1 38.0
I	46.0 46.0	1.213	39.9 39.6
J	24.8 24.9	1.112	18.6 18.6
K	12.8 12.8	1.058	9.3 9.1
L	12.3 12.4	1.060	9.5 9.6

The duplicate determinations of false and true potassium xanthate on each sample were made the same day.

Ashanti Again Roasting Its Ore

Metallurgists interested in the treatment of gold ores have given a great deal of attention to the problem before the Ashanti Goldfields Corporation, in West Africa, whose ore contains graphitic carbon and arsenic in unusual amount. In the *Mining Journal-Press* of May 31, 1924, the work being done at this plant was discussed editorially. Until 1922, the process consisted in drying, grinding, and roasting the ore, followed by a simple bulk leaching treatment. Fuel, however, was expensive, and in the last two or three years a different flow sheet was tried, embodying crushing the raw ore in cyanide solution and the separate treatment of sand and slime by usual methods. The extraction was not expected to be so good, but decreased costs were counted on to more than make up for the added metallurgical losses.

The revised flow sheet was, however, a failure and the company has gone back to the roasting method of treatment. The following comments and explanations from the latest report of the consulting enginer, W. R. Feldtmann, are of considerable interest:

"Dry crushing and roasting was resumed in February, 1924, with two furnaces, and has been gradually extended as more furnaces were brought into operation. In the year ended Sept. 30, 1924, about one-third of the total tonnage was treated by this method and the remainder by the wet process, the average extraction by the two processes being 80.9 per cent, compared with 74.7 per cent by the all-wet treatment in the previous year. Since the beginning of January, 1924, all seven furnaces have been working, and the whole of the output has been dry crushed and roasted for an extraction of 90.2 per cent.

"The roasting treatment has, as expected, not given such good results as it used to do, but its reintroduction has, nevertheless, justified itself handsomely, the more so as a good supply of cheap wood fuel has been available during the time that it has been working, on an increasing scale, from February, 1924, onward. There was, of course, never any doubt that roasting would yield the best extractions and little doubt that, given an ample supply of cheap fuel, it would also give the best economic result. But it was exactly this fuel problem—an ever-present source of anxiety and frequently the cause of absurdly high costs—which not only justified, but appeared to make inevitable, a departure from the standard roasting treatment in favor of some method requiring less fuel. The steps taken in this direction—that is, the methods of wet crushing and treatment—fell short of even the moderate expectations. On comparing the results of dry and wet crushing for the twelve months under review it is found that the extraction is about 10s. and the cost about 2s. in favor of dry crushing and roasting. As regards cost, however, it should be said that dry crushing was favored by an exceptionally good supply of cheap fuel. On the other hand, even if it had been necessary to use a considerable amount of imported coal, this would not, at today's prices, have canceled the whole of the benefit of improved extraction obtainable by dry crushing. The course at present indicated seems to be, therefore, to make the best of the 'all-roasting' treatment until further advance in metallurgical knowledge gives grounds for reconsidering the problem.

"When dry crushing was reverted to in February, the procedure was somewhat different from that formerly followed. The ore used to be dried in rotary driers and then crushed direct in ball mills through 25-mesh screens. On the resumption of dry crushing, the drying process was omitted and the crushing was effected in two stages, first through ¼-in. mesh and then through 15 to 18 mesh. No finer mesh could be used on the secondary ball mills without clogging the screens. Recently a Hum-mer screening plant has been installed for the primary ground ore, so that the relatively coarse and, incidentally, relatively dry material only will go to the secondary mills. By this means it is possible to grind rather finer in the secondary mills, and this may result in improved extractions. Failing this, however, it is recommended that the ore should be roasted at the primary ground stage and should then be wet ground in the Hardinge mills and passed over amalgamating tables to sand and slime cyanidation. This method will yield a higher extraction than it is at present possible to obtain, at a very small increase in cost. It will have the further merit of being the method best adapted to meeting successfully such increase in refractoriness as appears to be indicated for the deeper level ores.

"In an attempt to do away with the necessity of using wood as fuel for roasting, an experimental unit of coal-pulverizing plant has recently been installed. This method of firing is entirely novel to the type of furnace in use at the mines, and some time may elapse before any definite conclusion is reached. The latest information indicates that the machine will roast at an economical coal consumption, but that the trials are hindered by mechanical and combustion difficulties, which are, however, being overcome. The use of pulverized fuel as a heating medium in roasting is an experiment in two senses, in that neither the effect on the metallurgical treatment nor the degree of economy to be effected can be foretold with certainty. As regards the first point, if the heat can be satisfactorily distributed through the roasting furnace and does not concentrate too fiercely in one zone, there is not much risk of the metallurgical results being affected unfavorably. As to the second point, it will be necessary for pulverized fuel to show a very great economy to be on a parity with wood."

Russian Mines Increase Production

Copper and lead-zinc ores were obtained in comparatively small quantities in Russia during the fiscal year ended Oct. 1, 1924, according to *The Russian Review*. Copper ores were obtained by the "Uralmed" (Ural Copper Trust) in the Urals, and lead-zinc ores were found in the Northern Caucasus by the "Kavtsink" (Caucasus Zinc Trust). The quantities of ores mined works of the above-named organizations.

	1923–24 Tons	1922–23 Tons
"Uralmed" copper ores	105,000	66,500
"Kavtsink" lead-zinc ores	9,000	.....

The ores were shipped exclusively to the smelting works of the above-named organizations.

Among the other ores mined in the Urals, except iron and manganese, were chrome iron ore, asbestos, and magnesite. The following were the quantities mined:

	1923–24 Tons	1922–23 Tons
Chrome iron ore	4,750	970
Asbestos	8,100	5,400
Magnesite	30,600	17,000

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

The Mactear-Franks Mercury Furnace

THE EDITOR:

Sir—In *Mining Journal-Press* of Dec. 13, 1924, page 943, under the heading "Latest Metallurgical Practice in Treating Cinnabar Ores," there is an inquiry as to mercury furnaces and condensers. I will give you a short description of the "James Mactear-Franks muffle furnace," which is not known in the United States, but which was invented by Mactear for the Avala mercury mines, in Servia, in 1890. We erected three of them at this place, and since I came to Mexico in 1893 I have been developing and improving the furnace in many details of construction and in the condensers.

Many of these furnaces have been built in this state of San Luis Potosi, and every one of them has given satisfactory results, both on clean cinnabar ores, as also on the rather complex ores of La Trinidad mine, at Guadalcazar, where I erected the first one, having a capacity of ten long tons per twenty-four hours, and which is the only furnace used there up to date.

IRON RETORTS UNSATISFACTORY

The origin of this type of furnace was due to our having found iron retorts (the Ure furnace) very unsatisfactory, owing to their small capacity and to the formation of a coating of iron sulphide on the inside in spite of the admixture of lime. As the coating thickened, the firing had to be increased, which soon led to the bending and burning out of the retorts—let alone the unhealthful work of the discharging. We saw that in all other types of furnace in use at Idria, Spain, and California the combustion gases and extra air were mixed with the mercury vapors, so that the latter were enormously diluted, as is evident when you consider that the burning of every kilogram of firewood produces at least 8 cu.m. of gases. Now, like the moisture in the atmosphere, every cubic meter of gas is saturated according to temperature and pressure with an inextractible amount of mercury vapor; therefore, if the volume of the gases can be reduced, the loss from this source is reduced in proportion, and, as a corollary, the size of the condensers also. Further, the richer the vapors to be condensed, the more the liquid mercury produced and the less the amount of soot to be treated. Consequently, a retort of refractory material would be ideal, and this led to the building of a muffle with a low, thin arch of firebrick and a roasting hearth of rabbeted tile.

The fire gases pass underneath the tile hearth and sweep over the muffle arch to the chimney, never mixing with the mercury vapors. These latter are led out of the muffle through two iron pipes to two iron boxes (for safety's sake I like three boxes) of suitable size, connected in series. This is all that is required to condense the fumes. From these boxes the mercury and water from the moisture of the ore can be drawn off daily. The boxes are followed by a low, wide masonry flue, where—the fumes flowing, as in the old settling boxes for ore slimes, in a shallow slow stream—the mercury mist has a good chance to settle out. In the old style of settling chambers the fumes were carried up and down and thus kept constantly stirred up, reducing the facility for the deposition of the mist, or very finely divided globules of metal. The settling flue is provided with a regulating damper and connected with the chimney flue.

Ore is charged through the muffle arch by means of a hopper and a Franks charging head. The working doors are of convenient construction, and can, when desired, be closed hermetically, or any required quantity of air admitted to roast the ore. Lime is not required. Thus the volume of air mixing with the mercury vapors is under complete control and is reduced to a minimum.

Exhausted ore is discharged through a 5x12-in. hole in the door frame down a chute in the wall of the furnace to a car in a tunnel beneath. The men do not get salivated. If the muffle arch and hearth are properly constructed, no mercury is found in the combustion gases tested as they leave the furnace.

The furnaces in Mexico have been built in two sizes, the 9½x12-ft. and the 9½x20-ft. hearth, the first with a capacity of from five to six tons and the second of ten long tons per twenty-four hours.

In the smaller furnace there are two rabbling-discharge doors at one end of the furnace and one firebox at the other, or fume-take-off, end. The charge is worked to a finish as it lies.

In the ten-ton furnace there are two doors at either end and two fireboxes at the sides under the take-off-discharge end. One ton of ore is charged by hopper at the further end, and, after about two hours' heating, is raked over onto the front or finishing hearth, thus insuring at least one thorough rabbling, the vacant hearth being charged anew at once.

USE OF WOOD OR COAL FEASIBLE

The fuel required is from three-fourths to one ton of mezquite or oak per firebox per twenty-four hours. I have used lignite. Coal could be used also.

In Avala I worked 0.9 per cent ore; in La Trinidad and Dulces Nombres 3 to 3½ per cent ore. The lowest grade was in Guadalupana, where, with the high prices during the Great War, I roasted 0.30 dump screenings.

My experience all through has been that the loss of mercury is a constant quantity proportional to the time of roasting, or more correctly to the quantity of air admitted to the furnace per twenty-four hours.

In practice I have found it to be correct to reckon my extraction as the remainder of the assay value

after deducting 0.15 to 0.2 units from the assay. Thus I expect an ore assaying 1 per cent to give at the worst 8 kg. of mercury per ton of 1,000 kg., or an ore assaying, say, 3.2 per cent to give from 30½ to 30 kg. of mercury, according to the coefficient that has been determined by careful observation of each individual furnace. The weight of the mercury lost in each case is the same, but taking the above figures the percentage of extraction is very different and, as the work in both cases has been equally good, misleading. Thus, with a 1 per cent ore and a loss of 0.2 units, the extraction figures out at 80 per cent only, while a 3.2 per cent ore, with the same actual loss of metal, or 0.2 units, gives a 94 per cent extraction.

Curiously enough, I know of one mine where they treated hypo precipitates containing 16 per cent of mercury in a reverberatory furnace. They lighted the dried precipitate with a few sticks of wood and then closed the furnace, allowing the burning sulphur to do the rest of the roasting. In this treatment the weight of mercury lost per twenty-four hours corresponded to that in the muffle furnace.

In another mine about 50 per cent of the mercury contents of the ore is in the form of oxychloride, or terlinguaite. I found that this compound is not decomposed to any extent in the muffle, but that even before the moisture was fairly expelled from the ore, the oxychloride was volatilized as dense greenish-yellow fumes and collected in the condensers and settling chambers for further treatment.

No Iron Pipes Needed

Formerly the Mactear-Franks furnaces were equipped with iron boxes and a series of iron pipes as condensers, but in practice these pipes have been found to be not only unnecessary but also a great nuisance in the clean-up. The two or three iron boxes before mentioned are quite sufficient. My condensers are in the open and self-cooling. I do not use water. I have tried using water, but find that on account of too rapid cooling it tends to the excessive formation of mercury mist that is so difficult to recover.

We have also tried glazed sewer pipe, but found it too liable to crack on account of change of temperature, besides being a bad conductor of heat and affected with the same deficiency as the iron pipes; that is, awkward to clean up. Wooden and glass condensers were tried out at Almaden forty or more years ago and found wanting, as the woodwork dried out and leaked.

Supposing the fuel to be delivered close to the furnace and the ore bin to be near by, then two men with one helper can easily attend to two of the small-sized furnaces. The 20-ft. furnace requires four men, one at each door, for the quick raking of the ore from one hearth to the other. A helper in the furnace crew is also useful.

In Mexico, where labor is cheap, the furnace men get $1.25 and helpers $1 per twelve-hour shift, and where fuel is at $5 to $6 Mexican currency per ton of 1,000 kg., the cost of furnacing is from $3 to $3.50 per ton of ore.

The cost of labor on these furnaces, in spite of the high extraction of mercury, might prove prohibitive in places where wages are high.

San Luis Potosi, Mexico. W. Ernest Franks.

Pyrites as Fertilizer

The Editor:

Sir—In the March 28 issue of the *Mining Journal-Press* one of your correspondends raises the question of iron pyrites as a source of sulphur for plant nutrition, and its capacity to be oxidized in the soil to the sulphate form. The work of MacIntire, Shaw, and Young, reported in "Soil Science," Vol. 16, gives adequate answer to this question. In this experiment, which shows sulphates leached from the soil for five years, comparison is made of ferrous sulphate, iron pyrites, and elemental sulphur. The application of these materials was made so that the equivalent of 1,000 lb. per acre of sulphur was applied. The check cylinders, to which no lime or magnesia was added, show roughly that whereas approximately one-half of the added sulphur was removed by leaching during the first year, in the case of ferrous sulphate and elemental sulphur, only about one-fifth of the sulphur was removed from the soil to which iron pyrite was applied. At the end of five years the sulphate losses are nearly equal, the relative positions being, elemental sulphur 780 lb. removed, ferrous sulphate 759, and iron pyrite 709. The oxidation of iron pyrites to a sulphate is apparent.

The contemporaneous application of calcareous materials, especially in large quantities, retards the leaching of sulphates from pyrites, compared with an acceleration in the case of iron sulphate and sulphur. Probably the most serious point of issue with respect to the use of iron pyrites is not so much its slower capacity to provide available sulphates, as the tendency the iron would exert to combine with the soil phosphates, rendering it highly unavailable. To invite so undesirable a factor in soils simply to supply sulphur is ill advised when so many better sulphur carriers are available.

New York City. H. Clay Lint.

Zinc-lead-silver Ores in Coeur d'Alenes

The Editor:

Sir—The recent editorial in *Mining Journal-Press* under the heading "Zinc No Longer the Goat," dealing with the construction of custom mills in Utah for the treatment of zinc-lead-silver ores, applies to conditions in the Coeur d'Alene district, Idaho, with one very notable exception—namely, that no custom mills are being built to treat the ores. Possibly the success which has followed the establishment of custom mills in Utah may result in inducing some smelting concern to undertake a similar enterprise in the Coeur d'Alenes. The zinc-lead ores of Pine Creek present a most inviting opportunity for such a mill, which would also be in position to secure the same class ores from other parts of the district. There are at least four mines on Pine Creek now in position to supply tonnage to such a mill, and in addition numerous producers near by which would be spurred into activity if a market for their product were assured.

Some of the Pine Creek ore is of the so-called complex variety, and requires such extremely fine grinding that its profitable treatment by flotation may be questionable, but there is a large tonnage of zinc-lead-silver ores which has been proved amenable to selective flotation and which amply justifies the construction of a custom mill. A. J. Dunn.

Wallace, Idaho.

Consultation

Some Leading Metal- and Mineral-producing States

Will you have your statistical department advise me the states that are the biggest producers of the following natural resources:

Aluminum	Lead
Coal—hard	Natural gas
Coal—soft	Nickel
Copper	Petroleum
Gold	Zinc
Iron	

A correct answer to this question depends upon the construction given it. For example, Illinois is the leading aluminum-producing state, because the aluminum smelters are situated there, but the ore from which the aluminum is made comes from the State of Arkansas—the leading bauxite-producing area.

Pennsylvania is the principal anthracite-producing state. Pennsylvania also produces more bituminous coal than any other state.

Arizona mines and smelts more copper than any other state in the Union, but this production is shipped mainly to the Atlantic seaboard for refining—to Baltimore, Perth Amboy, and other refining points. At the same time, these refineries draw copper from other districts in both North and South America, so that their output of refined copper ready for the market is the greatest in the country.

California is the principal gold-mining and gold-producing state and has maintained that position for many years.

Minnesota is the chief iron ore-producing state, but its entire output is shipped out of the various producing sections and smelted elsewhere, either along the Lower Lake ports or in the Pittsburgh and near-by areas, mainly in Ohio and Pennsylvania. Hence Pennsylvania is the main pig-iron-producing state in the United States.

Illinois is the leading lead-smelting state, and draws its supply of ores and concentrates from Missouri principally, Missouri being the state with the greatest lead production.

Pennsylvania is the leading natural-gas-producing state.

There is no production of nickel in the United States from domestic ores. Canada supplies all the nickel used in the United States.

California is the leading petroleum-producing state.

Oklahoma is the leading zinc-producing state.

No Nickel Dross From Canada

"Can you give us the names of producers or exporters of nickel dross from the Canadian nickel district, and, if possible, the market quotations on such commodity?

"We do not know that we have ever seen this article listed among your quotations or in the articles which you have run on marketing the various metallic and non-metallic minerals."

There is, so far as we know, no nickel dross produced by either of the two companies operating in the Canadian nickel district. Their sole products are nickel matte (containing about 55 per cent nickel and 25 per cent copper), metallic nickel, Monel metal, and nickel salts for electro-plating. The nickel matte produced at the smelters is not sold in the open market, but goes direct to their own refineries.

The price of any other nickel-containing material would be dependent upon its nickel content and upon its adaptability to the purposes of the buyer.

The two operating companies are: The International Nickel Co. of Canada, Ltd., Copper Cliff, Ont., and The Mond Nickel Co., Ltd., Coniston, Ont.

Speed of Belt Conveyors

"Please give me some information about the proper and maximum speed of belt conveyors used in handling ores."

The maximum advisable speed for belt conveyors transporting ores depends principally upon the size of the belt used, although other factors, such as the construction of the idlers, size of pieces to be moved and their character, have an influence. The following table, taken from Mark's "Mechanical Engineer's Handbook," shows the maximum advisable speed for various widths of belting and ranges from 300 to 600 ft. per minute:

Maximum Advisable Speed of Belt Conveyors for Ore

Width of Belt, Inches	Speed in Feet per Minute	Maximum Size of Pieces	Width of Belt, Inches	Speed in Feet per Minute	Maximum Size of Pieces
12	300	2	32	500	15
14	300	2½	34	500	16
16	300	3	36	500	18
18	350	4	38	550	19
20	350	5	40	550	20
22	400	6	42	550	20
24	400	8	44	600	22
26	450	9	46	600	22
28	450	10	48	600	24
30	450	12			

The proper speed for a belt conveyor is the lowest that will give the capacity desired under loading conditions. As Hetzel states in his "Belt Conveyors and Belt Elevators": "A full cross-section of load at a slow speed means a deeper pile and proportionately less material in contact with the belt, hence less cutting and abrasion, less strain from pick-up of material and less energy wasted in revolving shafting and gearing and other conveyor machinery. . . . The full load distributes the load over more of the belt, the light load concentrates it in the middle; and when the belt is worn out in the middle, it is all worn out."

For inclined belts the speed should be reduced from the values given above for horizontal conveyors. Hetzel gives the following table in this connection:

Reduced Belt Speeds for Loading on Inclines

Angle of Incline	Percentage of Normal Speed for Horizontal Belt	Angle of Incline	Percentage of Normal Speed for Horizontal Belt
5	91	16	73
10	83	19	67
13	78	22	61

A slow speed on inclines reduces the tendency of the material to roll and cuts down the wear on the belt from slip. A belt conveyor that has to run constantly at its maximum speed to provide the capacity demanded has been poorly selected for the work to be performed. Maximum speed must be consistent with the proper loading and distribution of the material or it will shorten the life of the installation. Too great a speed, in any event, means noisy operation and unnecessary vibration of the idlers, whose design, incidentally, limits the permissible speed.

News of the Week

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Summary

CERRO DE PASCO'S production has not been affected by the recent torrential storms in Peru.

Shattuck Arizona is soon to start its lead concentrator.

Serious water shortage at Jerome, Ariz., may compel part-time operations.

Calumet & Hecla Consolidated may open another shaft in the amygdaloidal country.

The shipping season has opened on the Gogebic range.

The Quebec Government still opposes the construction of the proposed Rouyn branch railroad.

Miami Copper will prospect further for high grade ore.

Airplanes will be used to transport steel pipe to an Idaho placer mining operation.

A large order for dredging machinery has been placed in the United States by Russian platinum-mining interests.

The Mond Nickel Co. is to build a new plant at Frood, Ont.

Torrential Storms Damage Peruvian Railway

Cerro de Pasco Copper Production Not Affected by Floods—Shipments Out of Country Will Be Delayed

Unusually severe storms and floods along the west coast of South America have badly damaged the right-of-way of the Central Railway of Peru, which serves the Cerro de Pasco Copper Corporation. The mine and surface plant of Cerro de Pasco have been uninjured, and operations are being continued without interruption. As the company has sufficient supplies and fuel to last for many months no curtailment of production is necessary. The only inconvenience is that arising from the inability of the company to ship copper until the railroad operations are restored, which is expected to be early in June next. In the meantime the metal will have to be stored at the plant. Torrential storms seem to strike the west coast of Peru about once every forty years, it is said.

C. & H. May Open Another Shaft

Will Tap Osceola Amygdaloid Country

If miners are available, another shaft may be opened this summer by Calumet & Hecla Consolidated on the Osceola amygdaloid lode, in the Michigan copper district. The Osceola amygdaloid shafts are in good physical condition, despite their years of idleness. They are connected with the Calumet conglomerate by crosscuts, and the bulk of the water drains into the conglomerate. Were all of the six shafts on this lode in full operation, it is estimated they could provide an annual output of 1,000,000 tons of ore for at least fifteen years. The vein formerly returned a yield of only 16 lb. to the ton, but with the close selection practiced today, this could be increased several pounds.

In Calumet & Hecla's conglomerate department, considerable new ground remains to be opened and mined in the lower levels of No. 6 shaft, Hecla, from the 77th to the 80th level, inclusive, before the work of removing pillars and arches has been started. Mining backs of old stopes has started in the 60th level, and this program will be carried upward. In No. 9-10, Hecla, pillars, arches, and backs are being mined in lower levels, and an immense tonnage will be procured from this source. No. 7 shaft, which is opening drifts below the 81st level haulageway, is about to sink below the 85th. This shaft will be the only operating unit under the haulage tunnel, and will mine ground to the north and south under both Nos. 6 and 9-10.

Plymouth Mine To Be Sold

The Plymouth Consolidated mine and plant at Plymouth, Calif., is to be sold under a decree of foreclosure. J. Cademartori has been appointed commissioner to sell the property under orders from the Superior Court. So far no action has been taken by the English company interested in the property, and it looks as if none is intended. The obligation is $50,000, held by the Bank of Amador County, Calif.

Mines Make Heavy Contribution to Freight Movements

Largest Tonnage Handled in Fourth Quarter of 1924—Coal Leads; Iron-Ore Third

Products of mines contributed 1,114,662,945 tons of revenue freight to the Class 1 railroads of the country during 1924, according to Interstate Commerce Commission figures just compiled. This is 10.54 per cent less than in 1923.

The showing was better during the last quarter of 1924, when 171,153,101 tons of mine products were shipped. This is a decrease of less than 2 per cent compared with the fourth quarter of 1923. The details for the last quarter follow:

	Tons
Anthracite	19,053,922
Bituminous coal	93,424,012
Coke	4,086,439
Iron ore	9,705,676
Other ores and concentrates	2,714,067
Base bullion and matte	232,854
Clay, gravel, sand and stone	36,883,554
Crude petroleum	2,089,510
Asphalt	696,843
Salt	857,127
Other products of mines	1,409,097
Total	171,153,101

Phosphate Lands Classified

Tracts of public land approximating 4,000 acres in Montana and Utah were classified as valuable for phosphate during the past month, the Interior Department announced on April 17. In Montana, Utah, and Wyoming nearly 5,000 acres of public land were classified as non-phosphate lands after an examination by geologists of the U. S. Geological Survey. These areas have been designated as containing phosphate.

Standard Gypsum Co. to Work Deposits on San Marcos Island

Will Combine Quarrying With Glory-hole Mining—Plant Now Under Construction

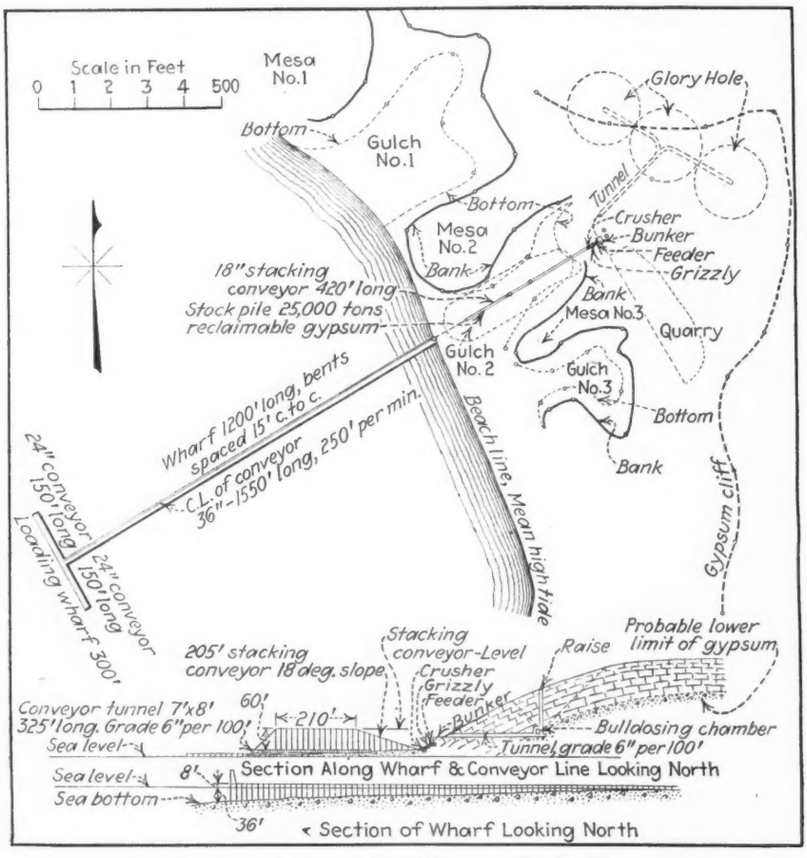
San Francisco Correspondence

THE gypsum deposits on San Marcos Island, in the Gulf of California, southeast of Santa Rosalia, Lower California, have been obtained as a mining concession from the Mexican Government by the Standard Gypsum Co., of San Francisco. A mining plant, wharf, and living quarters are now under construction on the island. The development and equipment installation is being done under the direction of W. E. Hindry.

San Marcos Island is 90 miles southwest of Guaymas and 14 miles southeast of Santa Rosalia. The island is 2 miles wide and 5 miles long. The deposit of gypsum overlies the south end of the island, covering an area 1½ by 2 miles. The thickness of the occurrence varies from 75 to 125 ft. An abrupt fault terminates the deposit at the north, and makes the dividing line of the sedimentary rocks on the north end of the island. The gypsum is of sedimentary origin and is practically free from overburden. A number of samples indicate remarkable purity. Insoluble ranges from 0.5 to 0.75 per cent; alumina and ferric oxide, 0.30 to 0.32; calcium carbonate, 0.44 to 1.03; calcium sulphate, 77.40 to 77.53; chemically combined water, 20.10 to 20.32 per cent. The gypsum content figured from the analyses averages close to 97 per cent, the range being from 94 to 99 per cent. The color ranges from light cream and gray to white.

The island is cut by deep, straight-sided gulches characteristic of regions of intense aridity, and these have afforded opportunity of estimating thickness and of sampling. The deposit is unlike most gypsum deposits in Nevada and California, as it presents a semi-alabaster structure and is darker in color, though purer than most gypsum now being worked on the Pacific Coast. The estimated tonnage is very large.

The method of working proposed is by quarries and a system of glory holes placed along the strike of the formation and connecting with drifts leading to a main crosscut adit. This adit begins at the crushing unit. The general plan is shown in the accompanying figure. The gypsum will be transported in 3-yd. rocker-dump type cars hauled by 4-ton Plymouth gasoline locomotives and dumped into a receiving bin. An apron pan feeder will discharge the gypsum over a grizzly and into a 44-in. jaw crusher (J. B. Ershan & Sons, Enterprise, Kan.). An 18-in. conveyor belt will remove the crushed gypsum and convey it to a vertical height of 60 ft. over the stockpile, which is to be 300 ft. long and will hold 25,000 tons live storage and 25,000 tons dead storage. A tripper will distribute the gypsum on the pile. A tunnel is to be dug underneath the stockpile and the live storage reclaimed through thirty gates equipped with automatic feeders discharging upon a 30-in. belt conveyor running the length of a 1,000-ft. wharf. At the end of the wharf two 24-in. cross conveyors will be arranged to discharge into fore-and-aft hatches of steamers at the wharf. The trippers and spouts on these conveyors can be spaced a maximum distance apart of 400 ft. and at shorter lengths so as to serve any hatchway distance. The loading capacity of the system is to be 10,000 tons per twenty-four hours.



Plan of initial operations on San Marcos Island. Pier, plant, and position of glory holes are indicated

The power plant comprises a 200-hp. Busch-Sulzer Diesel engine direct-connected to a 180-hp. G. E. alternating-current generator of 440 volts. All machinery is to be electrically operated. An Ingersoll-Rand compressor, 14 x 9 x 12, supplies compressed air for quarry operations. B. C.R. 430 Jackhammers are to be used for drilling and B. C. 25 paving breakers for breaking big lumps in the quarry. The gypsum drills readily, a 20-ft. hole being drilled at the rate of a foot per minute. A completely equipped machine shop is provided, with drill press, lathe, shaper, and necessary tools to make all repairs. Spare motors are also to be carried in stock for replacements. Power-drill-sharpening equipment is included.

Present plans provide for the erection of two calcining plants, one at Seattle, Wash., and the other at Long Beach, Calif., the former a two-kettle and the latter a three-kettle plant. The designs of these plants are now being made. At both, stockpiles of 15,000 tons' capacity will be maintained. Dockage facilities will be built at both places, so as to accommodate ocean-going vessels. Belt conveyor equipment will handle the gypsum, which will be unloaded from the vessels by clamshell buckets. The maximum particle size of the gypsum as shipped is 3 in.

At both calcining plants, the lump gypsum will be reclaimed by a belt conveyor or system feeding directly into a 42-in. rotary crusher reducing to ½ in. and thence into bins ahead of Raymond mills, which will be of 5-roller low-side type, grinding to from 90 to 92 per cent through a 100-mesh screen. The mill separators feed directly into the kettle bins. Screw conveyors transport the fine-ground product from the bins to the 10 x 8-ft. kettles, which deliver nine tons of calcined gypsum per charge. The kettles are oil-fired. A charge requires two and a half hours and a temperature of 340 deg. F. for calcination.

The calcined gypsum flows into 20-ton hot pits. The hot pits are served by a screw conveyor discharging into a bucket elevator and this in turn to storage bins. Ershan mixers and Bates automatic sacking machines are used in the final preparation of the finished products, which are fiber and unfibered hard wall plasters, casting plaster, finishing plaster, and land plaster. The Long Beach plant will have a capacity of 6,000 tons per month and the Seattle

plant a capacity of 4,000 tons a month.

The Standard Gypsum Co. began operations at Ludwig, Nev., in March, 1923. Its plant at Ludwig has a capacity of 9,000 tons per month. W. C. Riddell is chemical engineer for the company and Martin Uldall president and general manager.

New Zinc Concentrator To Replace Four Old Ones in Waco District

A plan to erect one large concentrating plant to take the place of four existing at present has been adopted by Frank Childress, of Joplin, and C. Bai Lihme, of Chicago, who recently purchased the interests of Franks & Danglade in the Waco, Mo., section of the Joplin-Miami district.

Four mills were included in the transaction, those of the Allegheny-Western, the Pyramid, the Freehold, and the Black Rock. The mill that will be erected to replace the four will be equipped with every modern improvement and be one of the model mills of the district.

The plan includes provision for handling a flow of water, and a big pumping unit has been installed at the Pyramid mine. It is possible that others will have to be added before the acreage can be worked down to the lower level.

The new owners had a drilling option on the property for some time before closing the purchase, and are understood to have blocked out some promising deposits. The purchase price was not made public, but is understood to have been about $100,000.

War Mineral Relief Claims Paid

Payment of three war mineral relief claims totaling $23,485 has been authorized by the Secretary of the Interior. The largest was to the Wisconsin-Georgia Coal & Iron Co., Cohutta, Ga., amounting to $15,706.60. The three awards have been certified to the Comptroller General for settlement by the government. The claimants and the amounts of the awards are given as follows:

W. J. Dozier, Polk County, Ark., $767.78; for losses in the production of manganese during the war.

The Manganese Products Co.. Stanislaus County, Calif., $7,100.08; for losses in the production of manganese during the war.

The Wisconsin-Georgia Coal & Iron Co., Whitfield County, Ga., $15,706.60; for losses in the production of manganese during the war.

Howe Sound Reduces Shares —Five Old for One New

The Howe Sound Co., holding company for the Britannia Mining & Smelting Co., in British Columbia, and the El Potosi Mining Co., in Mexico, has reduced its number of shares by exchange of five shares of old stock into one share of the new. The old $1 par stock was quoted at $2.50 to $3.50 on the various exchanges in British Columbia.

Gypsum deposit on San Marcos Island. The deposit occupies the low hills in the foreground and extends to the line of hills in the background

Grass Valley District, in California, Active

Milling has been resumed at the Brunswick mine, near Grass Valley, Calif. A new oreshoot was recently developed and is now productive. The mine has been kept unwatered for several years, but no production made. The Metals Exploration Co. held a six-months' option on the property, but recently decided not to continue it. J. Nilon is in charge.

Production by the North Star Mines in 1924 was $841,472 from 141,211 tons of ore. At the sorting plant 109,200 tons was retained for milling and the remainder rejected. The returns were $7.98 per ton; costs were $6.91 for mining and milling and $1.69 per ton for development. The net current loss from operations was $29,777. During the year 7,315 ft. of development was accomplished.

The Rainbow and Plumbago mines, in the Alleghany district, produced $14,000 in gold, but at a loss. The outlook for these properties is, however, promising. The North Star Mines has started an extensive campaign of shaft sinking, which will take about two years to complete.

Jail Interferes With Mining

An injunction against two placer miners in Idaho City was necessary to save the historic old Boise County Jail. The site of the old structure is known to contain rich placer ground, the only remaining remnant of the rich placers which produced many fortunes to early miners. D. Fruit and R. Lansing recently filed a placer claim on the jail site and threatened to remove the structure, which action was only prevented by the issuance of a restraining injunction by Judge C. H. Hortson of the District Court.

Shattuck-Arizona Mining Co.'s Mill To Start Operations

The lead concentrate mill of the Shattuck-Arizona, at the Denn mine site, is being put in condition to resume operations at an early date. It is planned to operate the plant continuously for twenty-four hours a day, working three shifts, though the crusher will be started up only every two or three days, to supply the mill for three days at a time. More than 150 tons of ore will be run through the mill daily.

J. H. Stanley, formerly assistant superintendent of the Tyrone, N. M., mill, and more recently shift foreman for the American Smelting & Refining Co. interests at Parral, Mexico, has been selected to take charge.

Open Call Exchange to Open in Newark

The Open Call Exchange, patterned after the method of trading in securities in Los Angeles and other Western cities, opened April 20 at Newark, N. J. Don C. Albridge is the president.

Though the idea in opening the exchange is primarily to trade in the better class of mining and unlisted stocks, it is understood that those conducting it expect soon to include other securities. In the beginning the listing will include mining share issues represented on the New York Curb, Boston Curb and Montreal, Toronto, Vancouver, Spokane, San Francisco, Los Angeles and Salt Lake City exchanges, and a number of unlisted securities will also be featured.

The exchange will operate under a charter with such Clearing House rules as to afford full protection to buyers and sellers in all transactions. Anyone financially responsible and conforming to the exchange rules will be permitted to trade.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Rouyn Branch Railroad Still Barred by Quebec

Ontario Government Has No Power to Expropriate — Delay May Cause Some Properties to Shut Down —Production Records

Toronto, April 18. Unchanged is the railroad situation between Ontario and Quebec and the extension of the Nipissing-Central-Kirkland branch into the Rouyn gold fields. The Premier of Quebec reaffirms his decision not to allow the Ontario Government to construct the road, and as it is found that the lands across which it would have to pass belong to the Crown, the Ontario Government has no power to expropriate, as the right of expropriation is vested in the Crown, which in this case is represented by the Quebec Government. The construction of the Abitibi Southern Ry., which is favored by Quebec, would result in a delay of a year or more over the time required for the Ontario line, and this may possibly end in a shutdown of some of the larger properties.

O'Brien Mine Making Progress

On the O'Brien property, in Cadillac Township, Quebec, good results have been obtained at the 100 level of the shaft, the average being approximately $11 across 6 ft. The ore at the bottom of the shaft is much better than near the surface, and the company will now proceed to do several hundred feet of drifting on the 100 level. A gasoline-driven mining plant has been installed, and it is proving to be more economical than a steam-operated plant using wood.

Rouyn Option Taken for $600,000 by Anglo-French Exploration Co.

The Rouyn Gold Pan Syndicate has optioned a seven-eighths interest in its properties near the Horne claims in Rouyn, for $600,000. The option has been taken by the Anglo-French Exploration Co., which will pay all expenses in connection with the development of the property, leaving the Gold Pan Syndicate with a one-eighth non-assessable interest. It is understood that a discovery has recently been made on this property showing considerable free gold.

Discovery Reported at Kirkland Lake

The Anglo-French Exploration Co. in addition holds the majority position in the Kirkland Lake Gold Mines, and it is understood that a discovery of good ore has been made within the last day or so, on the 1,600 level. A good deal of work was done and considerable ore milled, above the 1,000 level, on this property before it was taken over by the Anglo-French. Results, however, were barely sufficient to pay operating expenses, and in an endeavor to find better grade ore in more continuous shoots, the shaft was deepened. As soon as drifting is well under way on the new discovery, sinking will be continued to 2,000 ft.

The general tone of the recent annual meeting of the Dome shareholders was quite optimistic, although the officers of the company, in endeavoring to tell the shareholders of the actual position, exhibited better intentions than execution. The most outstanding recent development has been the discovery, made within the past two weeks, of a new orebody in the greenstone, lying to the north of the sediments. This orebody, which was intercepted by the diamond drill, shows $11.70 across a width of 40 ft., and is particularly noteworthy in view of the fact that this is the first discovery in the greenstones to the north of the sediments. Another new shoot has recently been opened up on the south side, and the indications now are that when the company is able to get underneath the sediments where the large orebodies occur, they should be found to extend into the underlying greenstones. The president also said that there was enough ore in sight to make reasonably certain the earning of a dividend for at least the next two years and that personally he was quite optimistic regarding further discoveries on the property. I. P. Allen, of Rochester, was added to the board in place of T. R. Finucane.

During March, the Vipond mill treated 5,195 tons of ore and recovered $50,100, an average of $9.65 a ton. Some additional diamond drilling below the 1,000 level confirmed the good results recently reported. The production at this property, for the first three months of the year, totals $141,900, recovered from 15,136 tons of ore, an average of $9.38 a ton, which is the best grade for the entire Porcupine camp.

The Lorrain Consolidated property, in South Lorrain, is starting shipments of mill rock to the Mining Corporation mill in Cobalt. Some high-grade ore has recently been found, but it will not be broken until the new rock house, now under construction, has been completed.

Nipissing Treats Record Tonnage in Last Quarter

The quarterly report of the Nipissing Mine for the three months ended March 31 shows that for the period the company mined ore of an estimated net value of $360,886 and shipped bullion of an estimated net value of $602,335. More tonnage was treated in the low grade mill during March than in any previous month since the mill has been in operation. During the three months the mill treated 20,253 tons and the high-grade plant treated 147 tons, shipping 884,923 oz. of silver.

For the same quarter the Keeley mine, in South Lorrain, produced 375,050 oz., of which 124,885 oz. is credited to the month of March. The Castle-Trethewey property, in Gowganda, produced 81,000 oz. during March, and the April production is expected to run about the same. This company should go on a dividend paying basis in the near future, it is currently reported.

The Everett property, in Gowganda, is to be reopened, and it is understood that some of the first work to be done will be diamond drilling.

London Letter

By W. A. Doman

Special Correspondent

Bwana M'Kubwa Issues Special Report

Varied Interests in Company Shown To Be Competently Represented— Huge Tonnage of Reserves Declared "Assured"

London, April 7.—Interest in the Bwana M'Kubwa Copper Mining Co. has been stimulated by the issue of a special report covering the company's general position and mining and metallurgical plans and showing how widespread and representative the management has become. A. Chester Beatty, and M. J. H. Francke (the last named formerly the Transvaal Government mining engineer) represent their own interests; Ewdard Birkenruth represents the Gold Fields Rhodesian Development Co.; D. O. Malcolm, the British South Africa Co.; J. C. Moulden, the Minerals Separation group, and Sir Ernest Oppenheimer, the Anglo-American Corporation of South Africa. Some of the shareholders are rather disappointed at what they regard as the insignificant interest which that company has secured, for as regards the N'Kana Concession it will collect a royalty on an agreed moderate basis, which is, roughly, 3 to 4 per cent, depending on the market price of copper. The argument is that fortunes may be made out of the share market before any copper is produced, and that 3 to 4 per cent royalty is totally inadequate. The company, it is said, should have had a kind of vendor interest. In the early days of the company all mining companies handed over a certain proportion of the share capital, and this enabled profits to be made in the event of the share market being good.

It would appear that the Bwana M'Kubwa company has scored. The ore reserves of the Bwana mine down to the 500 level are estimated at 7,568,365 tons of an average content of 3.9 per cent copper. The bulk of this is described as "assured tonnage." The report contains a full description of the treatment plant, by which from 70 to 80 per cent of the copper is extractable in the first few hours, and finally more than 90 per cent is obtained. The pilot plant has won 88.4 per cent of the copper from the ore in the adit level, 90.3 per cent from the 100 level, and 93.4 per cent from the 250 level.

The annual report of the Union Corporation contains some up-to-date information of the San Francisco Mines of Mexico. The water difficulty has apparently been overcome, for additional pumps have been provided, and development which had been hindered is being resumed on a normal scale. A new shaft is being sunk south of the main shaft to deal to a greater extent with the southern area of the property. Improved smelter contracts for the company's products came into effect beginning with October and January last.

With reference to the new sillimanite deposits referred to in the *New York Herald-Tribune* of March 27, in view of the fact that an experienced mining engineer spent some time at the locality nearly two years ago on behalf of London interests, who acquired control of a very large deposit, considerable surprise was expressed here at the news that "the only natural deposit of sillimanite in the world large enough to be of economic importance" had been discovered one hundred miles west of Calcutta and had been acquired by a New Yorker. The deposit referred to, however, appears to be the well-known kyanite deposit, from which fine specimens were exhibited at the 1924 British Empire Exhibition. Kyanite may find its special uses, but it is scarcely likely to prove an adequate substitute for natural sillimanite, notwithstanding textbook statements that heating is alone needed to bring about the conversion.

Yellow Aster to Build New Mill, Reported Locally

Local reports credit the Yellow Aster Mining & Milling Co., of Randsburg, Calif., with the completion of arrangements for the construction of the first 250-ton unit of a 500-ton mill. Open cuts and steam shovels are to be used in mining low-grade gold ores. Leasers are operating upon the property.

The Belcher Extension Mining Co. is reported to have struck a high-grade ore stringer in its property at Randsburg and to be preparing to sink to greater depth on the ore showing.

G. R. Colton, of Nevada, is said to have purchased an interest in the San Francisco Gold Mining Co., operating the King Solomon mine.

J. A. Dresser Testifies Bingo Ore of No Commercial Value

At the preliminary hearing at Winnipeg of the charges of fraud against Joseph Myers, managing director of the Bingo mine, on April 15, evidence was given by John A. Dresser, mining geologist, of Montreal, who stated that an examination of the underground workings of the mine showed the ore to be without commercial value. He referred, he explained, only to the mine, and not to the property, which was large and had not been examined. When known newspaper statements to the effect that samples taken from the mine had assays ranging from a trace to $132 per ton, he declared that the high values claimed were impossible. The evidence was given despite strenuous objection from R. A. Bonnar, counsel for the defence.

Lucky Jim to Buy a Concentrator

The Lucky Jim mine, at Zincton, B. C., has concluded negotiations for the purchase of a concentrator in proximity to the mine.

The mill is capable of handling 150 tons per day and will be used in milling the ores recently uncovered on the 100 level. The mill will be operating on Lucky Jim ores by June 1.

Johannesburg Letter

By John Watson

Special Correspondent

Transvaal February Gold Production 753,925 Ounces

Rand Mining Securities Quiet on Rumors of Further Taxation—Feverish Trading in Platinum Shares Continues

Johannesburg, March 17. — The monthly output of Transvaal gold for February was declared by the Chamber of Mines on March 10 as 753,925 oz., having a realizable value of £3,202,470. Compared with the production of the previous month, these figures show a decrease of 69,767 oz. and £296,351 in value. February had three fewer working days than January, and the daily average figure was 906 oz. better than that of January.

Since the recent interest in platinum properties to the north of Lydenburg developed, several new companies have appeared, some of which are now offering opportunities to the public to subscribe for shares. Lydenburg Consolidated Platinum Mines, Ltd., is the first flotation offering the general public participation at par; and 300,000 shares of 5s. each are being offered, all shares allotted under this issue to carry an option equal to one-half the number so allotted, which option runs up to the end of the present year. The company's prospecting interests include properties in the northern, central, and southern parts of the platinum field to the north of Lydenburg. The directors include J. E. Jones, the present chairman of the Johannesburg Stock Exchange; H. H. Morris, (an attorney); Morris Green, Emile Nathan, Dr. R. Ainslie Ross, and Mannie Solomon.

Doornhoek Platinum Mines, Ltd., offers 20,000 shares of 5s. each. The working capital is £10,000, of which £5,000 has been privately subscribed, and the balance is now being offered. This company has been formed to acquire options to purchase the freehold on Doornhoek No. 896, a portion of Geelhontkloof, and a portion of Welgevonden No. 1,772. These farms are all in the Waterberg district lying to the west of the property of the Transvaal Platinum, Ltd. Adolph Erasmus, who first discovered platinum in the Waterberg district, now claims to have found the "Elephant" lode in the mountain-side on Doornhoek. No shaft sinking will be required for some time, as the lode can be worked by adits. Rich assays by James Gray have been published, from samples taken by the chairman (Bernard Alexander). Other samples taken by Edmund Brayshaw were assayed by the Standard Bank, and some highly payable results were obtained. The directors of this company are Bernard Alexander, Johannesburg, (chairman); Sir Johannes G. van Boeschoeten, Pretoria; Edmund Brayshaw; William Oakley Thomas, Johannesburg; and E. E. Jones, Nylstroom.

The Dominion Platinum Corporation was recently formed and the capital privately subscribed. Some remarkable assays have been published. This company is operating on Zuikerboschfontein 1,015, Doornkom No. 480, and Doornfontein 1,806; in the Nylstroom district. The directors include C. O Thienhaus (chairman), Gustav Sonn, and Bernard Alexander.

On the Johannesburg Stock Exchange last week the market in gold shares has been quiet, owing to rumors of further taxation on the gold mines. The activity in land shares, with platinum interests, has been phenomenal. On Friday, March 13, T. C. Lands closed at 68s. 6d., showing a rise of 13s. 3d. during the week, and S. A. Townships closed at 25s. 6d. showing a gain of nearly 5s. during the same period. Transvaal Estate and Development shares were 8s. higher on balance, closing the week at 36s. 6d.

Miami to Continue Prospecting for High-grade Ore

J. Parke Channing Outlines Company's Plans for Discovering Faulted Orebody

The management of the Miami Copper Co. at the annual meeting held out little hope of finding the faulted part of the high-grade orebody of the company. J. Parke Channing, vice-president, said that prospecting for it would continue for a month or so longer.

When high-grade ore was struck in the faulted area the company officials had high hopes of developing it into an important orebody, but it proved to be only a small bunch of ore. Additional work has only disclosed scattered bunches, none large enough to work.

Eureka Smelting Co. Purchases 85-Mile Railroad

The Eureka Nevada R.R., a narrow gage line, 85 miles long, running between Palisade and Eureka, Nev., has been purchased by the Eureka Smelting Co. Negotiations were started nearly three years ago, when an option was granted to M. H. Briggs, an attorney for the smelting company, the option calling for payments to be made at intervals. The last payment was made early in April, and title has been transferred to the Smelting company.

Future plans of the new owners include the broadgaging of the railroad and addition of new rolling stock; also, construction of a 250-ton smelter at a point about midway between Palisade and Eureka, and extensive development of the Eureka Croesus mine.

Copper Queen Adds a New Division

Establishment of a new division was recently announced by officials of the Copper Queen mining organization at Bisbee, Ariz. It will be known as the Porphyry division, and will be placed in charge of C. H. Lewis, as foreman. The Porphyry is really a part of the original Sacramento division, but the change is made to allow closer supervision.

Russians Purchase Platinum-Dredging Machinery

Make Commitments Involving $1,200,000—Soviet Reorganizing Mining Industries

Five electric mining dredges, to be built by the Yuba Manufacturing Co., have been ordered by the Amtorg Trading Co. for the Russian platinum operations of Ural Platina. The first shipment is to be made in the latter part of this year, and delivery is to be completed by April, 1926. This order is believed a forerunner of additional purchases and is the first large-scale buying from Russian in many years.

The Soviet Government is reorganizing the mining industries and equipping some of them with modern mining machinery.

Development of Barbara Mountain by United Eastern Progressing Satisfactorily

The work in connection with the development of the Barbara Mountain property, near Mayer, Ariz., by the United Eastern interests is well under way. The company has already built a camp and erected a complete machine plant. Work on sinking the shaft has been started and is going on rapidly.

The United Eastern has agreed to expend such sums as may be necessary to sink a three-compartment shaft to a depth of 500 ft. and to crosscut from the bottom of the shaft to a point under the surface outcrop, an approximate distance of 300 ft.

The property consists of ten claims, located on Barbara Mountain, six miles east of Mayer. Across the top of Barbara Mountain extends a large outcrop of copper-bearing ore, which, according to the reports of engineers, has a width of 300 ft. and a length of approximately 1,500 ft. The ore cuts the very summit of the hill, and surface assays from samples taken across the entire width are said to show a copper content of about 10 per cent. The shaft, as located by the United Eastern engineers, is about 300 ft. to the west of the center of the outcrop, and the collar is 400 ft. below the top of the mountain. A depth of 500 ft. in the shaft, therefore, means a total depth of about 900 ft. from the summit.

Water Shortage in Jerome May Compel Mines To Operate on Part Time

The camp of Jerome, Ariz.. owing to the long-continued drought and the increase in population during the past two years, is threatened with danger of a real water shortage. Every possible effort is being made to conserve the supply, the water for domestic use even being shut off during the hours of 10 p.m. and 5 a.m. The Upper Verde Public Utilities Co. is doing considerable work on pipe lines and sources of water supply, which will entail an expenditure of about $80,000 when completed, but this work will require time and does not in any way relieve the existing shortage.

A serious feature about the situation is the danger of the United Verde Copper Co.'s mine being compelled to go on a part-time basis, with a consequent loss of wages and decrease of possible employment.

Notices have been posted, and everyone is being asked to cut his consumption of water to the minimum.

Dr. Lind Leaves Bureau of Mines

Dr. S. C. Lind, chief chemist of the Bureau of Mines since 1923, has resigned to become assistant director of the Fixed Nitrogen Laboratory of the Department of Agriculture. The radium work of the Bureau of Mines has been turned over to the Fixed Nitrogen Laboratory, so that it may continue under the personal direction of Dr. Lind.

Dr. Lind is regarded as one of the government's best research chemists. In addition to his work on radium, he has become known widely for the work he has done on helium. He was in charge of the Rare Metals Station of the Bureau of Mines at Reno for two years, and has been a member of the staff of the Bureau of Mines since Feb. 26, 1913. Prior to going to Reno he served for two years as superintendent of the station at Golden, Colo.

Though it is admitted by all familiar with Dr. Lind's work that his acquisition by the Department of Agriculture augurs well for accelerated progress in nitrogen research, it involves the loss to the Bureau of Mines of one of its best minds and the man who had been relied upon to shoulder most of the new responsibilities in connection with the work on helium. In his new position Dr. Lind will be principal assistant to Dr. F. G. Cottrell, the director of the Fixed Nitrogen Laboratory.

Railroad Land Selections Must Be Published

One of the causes of complaint in connection with the filing of railroad selections has been that the railroad company was not required to publish a notice of the lands it was selecting, and that the miner or prospector who happened to have claims on any of the lands selected had no opportunity to file a protest. It has always been the practice to have such selected lands examined by a representative of the General Land Office before issuing patents, but to avoid any possibility of the railroad company's obtaining patent to any lands claimed by a miner, the Land Office has come to consider it advisable to require a notice of all such railroad selections to be published in a newspaper of general circulation published in the county in which the lands selected are located.

The Department of the Interior, having been impressed with the desirability of making such a change in the regulations, has issued a circular dated March 28, 1925, requiring that in the future such notice be published with respect to all railroad selections filed. The circular is No. 988 and has the following title: "Grants of Land to Aid in the Construction of Railroads and Other Purposes."

Annapolis Lead Co. in Hands of Receiver

Tornado Wrecked Plant, With Loss of $400,000—Stockholders Seek Injunction to Conserve Assets

As an aftermath of the tornado of March 18, which swept southeastern Missouri, southern Illinois, and parts of Kentucky, Tennessee, and Indiana, the Annapolis Lead Co., of Annapolis, Mo., is in the hands of a receiver. M. C. Rhoads, a St. Louis real-estate man, former president of the company, was appointed temporary receiver for the company by the Circuit Court at Ironton, Mo., on April 13.

The receivership suit was instituted by several stockholders, who also asked for an injunction to restrain the officers from disposing of any of the company's assets. The petition alleges that as a result of the tornado, which wrecked the company's plant, causing damage estimated as high as $400,000, the company is insolvent and that no attempt has been made to prevent water flooding the mines.

The company was organized by St. Louis interests about five years ago. Approximately $2,500,000 was spent in developing the property on a 1,000-acre tract at Annapolis. Two years ago the company began ore shipments on a large scale.

Asbestos Deposit Being Developed in Porcupine District

Some of the discoveries of asbestos which have been made in the Porcupine gold area of northern Ontario are believed to be of economic value, and an effort is being made to establish an asbestos industry in that district. The Porcupine Asbestos Mining Syndicate, of which E. D. Bowman, of Timmins, is president, has four claims in Deloro Township, about 3½ miles south of the Dome Mines, has begun development, and made a trial shipment of asbestos, said to be of fine quality.

The asbestos-bearing rock has been traced for a length of about one mile, with a width of 2,000 ft. and more in some places.

Shipping Season Opens on the Gogebic Range

The shipping season on the Gogebic range has opened, and several of the mines are forwarding their daily hoist to the docks at Ashland. The first ore boats are expected in the harbor at Ashland on April 20. It will probably be a few weeks before the mines start to ship ore from their stockpiles accumulated during the winter.

The Ashland mine, at Ironwood, Mich., has been closed down by the M. A. Hanna Co. for an indefinite period. The pumps have been pulled and practically the entire force of men has been laid off. The recent 50c. cut in the price of ore made it unprofitable to continue operation of this mine. The one hundred and thirty or more miners thrown out of work there are finding difficulty in getting work elsewhere, as the low price for ore is bringing curtailment at other mines.

North Arkansas Zinc Properties Active

New Local Ore Market Established—Small Lots of Free Lead Also Aid Production

For the first time since the war, zinc mines in the vicinity of Zinc, Ark., are producing. L. L. Brown, who purchased most of the ore during the high-price period of 1914, 1915 and 1916, has opened a local ore market, and production is beginning to respond.

The Salina Mining Co., which conducted a drilling program last winter, has opened up a nice face of "jack," has its mill in operation, and is making a fair production of ore.

Lawhon, Peterson, and Morris, who are operating the Minnie Lee mine, struck a fine run of silicate last week and are making a good production. They have taken out some boulders that have weighed as much as 1,000 lb. This ore was encountered in an open drift and was found practically at grassroots. It is free ore, and needs no milling, being ready for shipment as it comes from the ground. They also have good showings in three other drifts.

L. L. Brown & Co., who recently leased the Harvey land, have started a tunnel just below the old diggings and have encountered a good face of silicate.

Besides the zinc ore being sold at Zinc, small lots of free lead are also being marketed there from the Short Mountain and Dodd City areas.

Federal Tries Concreting Shaft —Timber Won't Hold Ground

To concrete a shaft as a means of protection against fire is not an unusual occurrence, but the problem that confronts the Federal Mining & Smelting Co. in dealing with the shaft at the Morning mine, at Mullan, Idaho, is an altogether different problem in the use of concrete. Here it is not protection against fire, but protection from the constant movement of the walls surrounding the shaft, a pressure so great that it crushes heavy timbers as if they were kindling wood, and makes necessary a large force to replace timbers and encroaching rock so as to maintain the alignment of the shaft and keep it safe for operation. Obviously, this is a heavy expense, and how to get rid of it has been a problem to which the Federal management has devoted years of study, including consultation with outside engineers and geologists.

Two theories are advanced in explanation of the phenomenon. One is that it is an earth movement which no human agency can stay, and the other is that the movement is local, that it is caused by a slacking process caused by exposure of the rock to the air. Acting upon the latter theory, the management of the Federal company a few months ago decided to try an experiment by pouring a solid wall of concrete around the framework of the shaft. A section of the shaft below the 2,650, the lowest, level in the Morning mine, was selected for the test, this being chosen to avoid interference with the usual operations in the mine. Forms were placed around the shaft proper and the space back to the rock walls was filled with concrete. Beginning near the bottom of the shaft or sump, concrete was poured around the shaft to a height of 90 ft., or practically up to the 2,650 level. The experimental job has now been completed. Much of the concrete that was first poured is thoroughly set and shows no evidence of strain upon it. It will be observed for about three months, and at the end of that period, if it shows no unfavorable features, the management will regard the problem solved and proceed to give the entire shaft the same protection.

Mond Nickel To Build Plant at Frood Mine

THE construction of an extensive mining plant has been begun by the Mond Nickel Co. on its Frood property, in the Sudbury district of northern Ontario, where the company is now raising ore at the rate of 1,000 tons per month. The International Nickel Co. is preparing to do considerable exploration work on its Frood property adjoining that of the Mond. Preparations are being made for the construction of a permanent road connecting the new town of Frood with Sudbury, the center of the nickel area, which will materially assist the development of the Frood deposit.

Many Prospects Being Developed in Mexico

Development of a group of eighty claims in the Encinillas Mountains in Mexico, which were recently filed upon by Paul Ginther, of Santa Rosalia, State of Chihuahua, has been started.

The Mexico Libre mine, in the Guadalupe y Calvo district, State of Chihuahua, has been acquired by T. E. Ivey, who will install new machinery and place the property on a producing basis. The ores contain good values in gold and silver.

The old workings of the Oriental mine, in the Santa Barbara district, State of Chihuahua, which was recently purchased by Jesus Trevino, are being cleared out. The shaft will be sunk to greater depth and the ore production increased, according to current reports.

In the Guerrero district, the Potosi Industrial Co. has taken over the Buena Vista mines, which will be developed. The property consists of sixteen claims which have been worked but little.

Mining men of the State of Durango are much interested in the project now being promoted of constructing a large hydro-electric plant in the mountains of that state for the purpose of generating power and supplying mines and other industries. It is expected that the use of electric power will make possible the operation of many miles which cannot now be profitably worked under existing conditions.

Airplane To Aid Idaho Placer Mining

Will Transport 117,000 Lb. of Steel Pipe to Mine in Rough Mountainous District

Transporting 6,000 ft. of steel pipe, representing a weight of 117,000 lb., a distance of 30 miles across a mountain range 6,000 ft. above sea level by airplane is a feat that will be undertaken before spring is far advanced, if negotiations now pending between the Independence Placer Mining Co., of Wallace, Idaho, and Lieutenant Mamer, an aeronaut, of Spokane, are consummated. This company for many years has held a large tract of rich placer ground on the North Fork of the Clearwater, in Idaho, near the site of the old camp of Moose City, famous for its rich diggings in the early days. However, its remote and inaccessible location has rendered it practically impossible to deliver necessary equipment for working the ground on a large scale.

Last summer an exhaustive examination of the ground was made by a placer miner of wide experience, and his report was so favorable that arrangements were made with Sydney L. Shonts, a mining engineer of Wallace, to finance the enterprise. It is planned to work the ground by hydraulic mining, and this involves laying 6,500 ft. of steel pipe, 3,000 ft. of which will be 20 in. in diameter, 2,500 ft. 15 in. and 1,000 ft. 10 in.

The first plan was to have this pipe made in 6-ft. sections and packed from the railroad across the divide to the placer ground, a distance of 40 miles, a slow and expensive method. Then the bright idea was suggested that the pipe might be delivered by airplane, and conference was held with Lieutenant Mamer, who has a string of airplanes for commercial service. He has three planes each with a carrying capacity of 640 lb., and he expressed confidence that he could do the job successfully and in record time. The pipe is being manufactured in Spokane, and arrangements will be made to try out the plan there, the pipe being made in 12 ft. sections instead of 6 and the smaller pipe nested in the larger. If successful the pipe will be delivered by railroad to Iron Mountain, Mont., where there is an open field for taking off and landing, and from which it is 30 miles in an air line to the placer ground in Idaho. Although it is in a rough, mountainous country, it is said that there are two places where a landing field can be prepared. Mr. Mamer says that he can make the round trip in an hour and within thirty days he can deliver the 6,000 ft. of pipe.

The elevation of Iron Mountain is about 2,500 ft. above sea level, and the summit of the divide between Montana and Idaho is 6,000 ft. high thus requiring a rise of over 3,500 ft. At Fish Lake, on the divide, there is a federal forestry station and open ground, where a landing can be made in case of emergency. A representative of *Pathe's Weekly* has arranged to take pictures of this novel performance, and also to take passage on the plane to secure views of this wild and romantic country.

Societies, Addresses, and Reports

Hans Lundberg Addresses A.I.M.E. on Electrical Prospecting

John A. Church, Jr. Elected Chairman of New York Section for Coming Year

At the annual meeting of the New York Section of the A.I.M.E. held at the Harvard Club on April 15 Hans Lundberg, of the Swedish American Prospecting Co., described the method his company has developed for prospecting by electrical means. It depends upon the use of electrodes extended on the ground and the disturbance created in the electrical field between these electrodes by the presence of orebodies.[1] Mr. Lundberg brought with him some electrical apparatus to illustrate the method and showed many diagrams to indicate the theory upon which the system works. Electrical prospecting in northern Sweden in the Skelleftea district had been successful in locating the presence of large ore deposits. Although Mr. Lundberg has been using the method in the United States recently, he did not express himself as to the results obtained here.

Professor LeFevre, in discussing Mr. Lundberg's address, told of the wide use in the iron regions of the dip needle and the splendid work which it has done in prospecting. H. N. Spicer asked if the method were applicable to the location of coal beds and oil pools. Mr. Lundberg said that not enough work had been done to demonstrate the usefulness of the method in coal prospecting. Further interrogation by R. N. Atwater, Jr., developed the fact that the method could not determine the grade of the ore discovered, but that a disseminated orebody might be distinguished from others. C. M. Weld, through a question, brought out the fact that the dip of orebodies could be readily determined. Mr. Lundberg said that insufficient work had been on the non-metallic minerals to find out how useful the method was in prospecting for deposits of such minerals as fuller's earth, diatomite, and others.

Officers of the section for the coming year were elected at the meeting. After the ballots had been counted it was found that the following members had been chosen: Chairman, John A. Church, Jr.; vice-chairmen, E. L. Gruver and R. M. Raymond; treasurer, M. H. Merriss; and committeemen, S. H. Ball and C. S. Witherill.

Fort William, Ont., Organizes Chamber of Mines

The Northwest Ontario Chamber of Mines was organized at Fort William, Ont., on March 27, with Peter McKellar as president. The objects of the organization are to help prospectors, to prevent wildcatting, and to furnish correct information regarding the mining possibilities of the district.

[1]The method is fully described essentially as Mr. Lundberg presented it at the meeting in the April 5, 1924, issue of *Mining Journal-Press*.

Engineering Foundation's Year Reviewed

Annual Report Issued—Organization Now Has Local Representatives in Twenty-seven Cities

Progress was made by Engineering Foundation in furthering research during the year ended Feb. 11, 1925, according to the annual report of the Chairman and Director that has just been published. Contributions of funds and services were made by the Foundation to six research projects of its Founder Societies. Co-operation with the National Research Council was maintained. Several proposals for research were examined, but aside from an appropriation for the investigation of strength of gear teeth by the American Society of Mechanical Engineers, no new projects were undertaken. Collection of selected engineering data into a series of volumes, engineering research fellowships and professorships, management of a fund for agricultural chemical research, airplane surveying of mountainous regions, and treatment of complex ores were among the proposals considered.

A bequest to United Engineering Society in the will of Henry R. Towne, past-president and honorary member of the American Society of Mechanical Engineers, who died Oct. 15, 1924, provided for establishing the Henry R. Towne Engineering Fund of $50,000, the income of which is to be devoted to the general purposes of Engineering Foundation. Information was received of other intended legacies, the report states. In accordance with resolutions of the Founder Societies, special efforts are being made to add to the resources of the Foundation.

One hundred and ninety leading engineers in twenty-seven cities accepted the Foundation's invitation to serve as informal local representatives. They include one state governor, many past and present officers of national and local engineering societies, and executives of important corporations.

During 1924, Engineering Foundation made appropriations for thirteen researches and co-operated in other ways. Of these the only research that was conducted under the auspices of the American Institute of Mining and Metallurgical Engineers was that on mining methods. The mining methods committee made a thorough survey of the best literature available on mine sampling and estimation of orebodies and is preparing a statement as to the best and the safest methods to pursue. Prof. R. M. Raymond, of the School of Mines, Columbia University, is chairman, and B. B. Gottsberger, Hammond Metallurgical Laboratory, Yale University, is associate chairman.

The lubrication committee of the American Society of Mechanical Engineers included in its program for 1924 participation in a co-operative study of mine car friction, at the U. S. Bureau of Mines and the Carnegie Institute of Technology, Pittsburgh.

The American Bureau of Welding continued to foster scientific investigations in various branches of the art of welding metals by electricity, gases, and other means. Dr. D. S. Jacobus has been the Foundation's representative.

Without appropriation of funds, the Foundation co-operated in the rock-drill steel research. This was continued by the U. S. Bureau of Mines and the Bureau of Standards under the general oversight of an advisory board representing the American Institute of Mining and Metallurgical Engineers and other organizations. Prof. Herbert M. Boylston, of the Case School of Applied Science, Cleveland, Ohio, is Engineering Foundation's representative.

Engineering Foundation's income from all sources during the calendar year 1924 was $28,599.53; the total fund available, including balance from 1923, was $63,258.38 and the total expenditures for all purposes were $23,403.87. A credit balance of $39,854.51 was carried forward into 1925.

The report is signed by Charles F. Rand, chairman, and Alfred D. Flinn, director.

American Refractories Institute Holds First Meeting

The first meeting of the American Refractories Institute was held at the Mellon Institute, University of Pittsburgh, Pittsburgh, on April 14. Thirty-six manufacturers of refractories and twenty-six technical men and representatives of the consuming industries attended this meeting.

P. S. Kier, of the Kier Fire Brick Co., Pittsburgh, was elected to serve as acting chairman, and after the appointment of a nominating committee several talks and technical papers were given. J. D. Ramsay, president of the Elk Fire Brick Co., St. Mary's Pa., who has been active in promoting the Institute, talked on the purposes of the organization, emphasizing the fact that the co-operation of the consumers was necessary for the success of this project and pointing out the benefits to the consumers through the use of the research and testing divisions and the opportunity for presenting problems and complaints before an organized body of manufacturers.

Southern Exposition in May

The Southern Exposition will be held in Grand Central Palace, in New York, from May 11 to 23 inclusive. The International Exposition Co. will stage the exhibits. The purpose underlying the undertaking, it is said, is to show to the world what the South is doing; not the South as it was, but as it is. An effort will be made to show the advance made by the Southern states in mining, agriculture, horticulture, manufacturing and commerce.

Co-operating with the exposition are individuals, chambers of commerce, manufacturing and trade associations, agricultural societies, development boards, railroad, mining, timber, land and power companies, industrial bureaus, and other agencies. These are aiding in conducting a national advertising campaign.

Men You Should Know About

F. L. Bosqui, Jr., will sail from Southampton for Johannesburg on May 7.

Robert A. Kinzie, mining engineer, of San Francisco, has returned from the west coast of Mexico.

A. H. Collbran, of Seoul, Korea, passed through Vancouver on April 10, on his way to London.

Arthur W. Burgren has left the Dolores mines, at Matehuala, S. L. P., Mexico, and is now with the San Pedro mines, at San Luis Potosi.

Amos L. Beaty, of New York, was re-elected president of the Texas Company at a meeting of the stockholders in Houston, Tex., on April 7.

Horace B. Strong, mining engineer, has been placed in charge of operations at the Bidgood mine, at Kirkland Lake, Ont., which is being reopened.

Jules La Barthe, a metallurgist of San Francisco, has been at Thompson, Nev., inspecting changes and repairs to the Thompson smelter, which will be blown in within a few months.

Leland E. Wemple

Leland E. Wemple, for the last eighteen months vice-president and general manager of the Illinois Zinc Co., has been elected president of the company to succeed **Benjamin G. Wells,** resigned. **John M. Goetchius,** of New York, has been re-elected chairman of the board and **R. E. Meyer** re-elected secretary.

G. H. Sharrer, who has been operating a gold dredge in Colorado, is now in San Francisco en route to Fairbanks, Alaska, where he will have charge of dredging operations in that district.

Charles Bocking, former manager of the Butte & Superior Mining Co., arrived at Anyox, B. C., recently, where he has taken the position of general manager of the Granby company, succeeding **H. S. Monroe.**

T. L. Smith, mining engineer for the Tonopah Mining Co., is on his way to the Long Lake and Bull Dog Lake district of Manitoba to examine a number of mining properties in the interests of the company.

J. Fred Johnson, mining engineer, of Eureka, Utah, who had charge of concreting the shaft of the Morning mine, at Mullan, Idaho, has gone to Grass Valley, Calif., where he has a contract to sink the shaft of the North Star mine.

James R. Evans, who is connected with the Companhia de Diamantes de Angola, arrived in New York recently from Africa. He left for Butte, Mont., on April 11, where he will spend a short vacation with his brother, **B. F. Evans.** He expects to return to Africa in July.

Dr. Kuno B. Heberlein

Dr. Kuno B. Heberlein has resigned the presidency of the Metallurgical and Chemical Corporation, 42 Broadway, New York, having disposed, together with his associates, of their entire holdings of this company to the National Lead Co., as recently announced. This transaction includes not only the refinery at Matawan, N. J., built and operated by the company, but also the exclusive patent rights for the United States to the Harris process as far as they pertain to the treatment of secondary lead material.

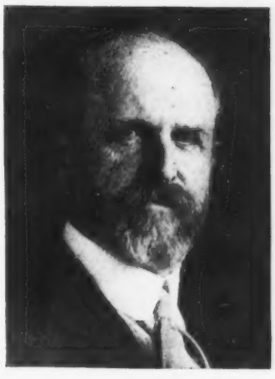
Henry M. Parks, mining engineer and geologist of Portland, Ore., has been in San Francisco in connection with a plan of land development in Oregon.

John P. Gray has been in Tonopah, Nev., where he represents the West End and affiliated companies in apex litigation against the Tonopah Extension Mining Co.

G. A. Stockfeld, mining engineer, has left London for Buenos Ayres in connection with the interests and concessions controlled by the South American Proprietary, Ltd.

Obituary

David Talbot Day, who for forty-five years had been an active figure in geological circles, died in Washington on April 15. Dr. Day was the father of the Minerals Resources Division of the U. S. Geological Survey. When he became a member of the Survey, in 1886, statistics of mineral production were obtained from secondary sources. He organized the work and established the policy of close personal contact between the technical men at the Survey and the producers of minerals. Dr. Day was born in Ohio, on Sept. 10, 1859. He was graduated from Johns Hopkins in 1881 and obtained the degree of PhD. from that institution in 1884. He was an instructor in chemistry at the University of Maryland for a few years prior to joining the Geological Survey, and was in the service of that agency continuously from 1886 to 1914, in which year he was appointed a consulting chemist on the staff of the Bureau of Mines. His work on the Rittman process of petroleum refining attracted wide attention. He also did extensive work for the Bureau of Mines on oil shale. In addition to his Bureau of Mines work he acted as a general consulting petroleum geologist. Dr. Day gave generously of his time and money in behalf of public-spirited enterprises. For many years he was secretary of the Joseph A. Holmes Safety Association. He served without salary and traveled extensively in an effort to arouse interest in that organization. He was an exhibitor at the Centennial Exhibition in Philadelphia in 1876; was in charge of the petroleum exhibits at the World's Fair in Chicago in 1893, director of



Dr. David Talbot Day

Mining at the Cotton States' Exhibition in Atlanta in 1896, and at the Tennessee Centennial, in 1897, he was secretary of the Jury of Awards. He had charge of petroleum exhibits at the World's Fair in Paris in 1900. At the Buffalo Exposition in 1901 he was in charge of mining exhibits. He was honorary chief of the Department of Mines and Metallurgy at the St. Louis Exposition in 1904; at the Lewis and Clark Exposition in Portland in 1904; and at the Jamestown Exposition in 1907. In 1912 he was president of the Fuel Section of the International Congress of Applied Chemistry. Dr. Day was particularly active in the technical societies, wrote extensively on those subjects which he had made a life study, and contributed a great deal of his time to the Geological Society of America. He was a member of the A.I.M.E. and of the American Chemical Society.

Frank Lenox, mining man, and widely and favorably known throughout Arizona as a flotation operator, died recently at Patagonia, in that state, after a short illness. He is survived by a wife and two small children.

Recent Technical Publications

Reviews, Abstracts, and References

Ore-Dressing Machinery

The Screening and Grading of Materials. By J. E. Lister,

Crushing and Grinding Machinery. By Hartland Seymour.

Published by Ernest Benn, Ltd., 8 Bouverie St., London, E. C. 4, England. Price, 6s. each.

These two little books, each of about 140 pages, form a part of a "Chemical Engineering Library" being put out by these London publishers. The books describe the construction and operation of the machines available in England for carrying out the work indicated by the titles. Many of these appliances, of course, are the same as those used in this country, so the information given is not without value to engineers on this side of the ocean. Not much attention is paid to theory, but it has evidently been the intention to make these volumes practical little handbooks which will be useful to those who wish to know the characteristics of the various machines available for certain kinds of work.

A Treatise on Colloids

The Theory and Application of Colloidal Behavior. Edited by Robert H. Bogue. McGraw-Hill Book Co., New York. Two volumes, not sold separately. Price, $8.

This work is the result of a collaboration of thirty-four authorities, so that it cannot be said to be a narrow-minded presentation of the subject. Much of the matter contained in the two volumes is not of direct interest to mining engineers, and yet most of the discussion will prove enlightening to the thoughtful geologist and metallurgist. The importance of colloids in ore deposition and mineral replacement, in certain processes of ore dressing and concentration, and in smelting and refining, was not recognized a few years ago, and most engineers have no very clear idea of the subject now. Of special interest to our readers will be the chapters on emulsions and foams, adsorption, the colloid chemistry of minerals and ore depositions, colloidal phenomena in metals and alloys, the precipitation of smoke and other suspensoids in gases, and the colloid chemistry of silica and its derivatives.

Practical Mathematics

Practical Mathematical Analysis. By H. von Sanden. Translated from the German by H. Levy. E. P. Dutton & Co., New York. Price, $4.50, postage extra.

Mathematics for Technical Students. By E. R. Verity. Longmans, Green & Co., New York. Price, $4.

Practically every engineer emerges from college well trained in mathematics, but at the end of five or ten years few could pass an examination that would hold no terror for the average high-school student. A knowledge of the simpler arithmetical computations, the very simplest algebra, and a working knowledge of the slide rule answers for a large number of graduate engineers. And yet, the time often comes when one feels the need of brushing up on mathematics, in order to fathom some published article or to soive an unusual problem that may have arisen. Either of the books mentioned above will prove useful in this connection. Neither book is of American origin, but the European practice of mathematics seems to be much like that in the United States.

Von Sanden's volume contains chapters on the following subjects: General considerations of numerical and graphical calculation; slide rule and calculating machines; rational integral functions; extrapolation and interpolation of a rational integral function; interpolation, numerical differentiation and integration of arbitrary functions; mechanical quadrature; graphical integration and differentiation; analytical approximation to empirical functions; solutions of equations; and graphical and numerical integration of ordinary differential equations of the first, second, and higher orders. The accessibility of the material in this book would have been increased if the publisher had cut the pages.

Verity's book is somewhat more on the order of a textbook; in fact, the object of the author was to provide in one volume a course of mathematics for engineering and other students in the evening classes of technical institutions. The theoretical matter is given practical application in numerous problems, whose answers, if one is inquisitive, may be found at the end of the book.

Year Book and Directory of the *South African Mining and Engineering Journal;* 1925 edition. Johannesburg. Price, 10s. 6d.

This book is becoming better and more complete with each issue. The present volume leaves little to be desired as a compendium of information about the mining industry of South Africa. The work of each of the mines for the year is summarized, many photographs being included, and a large amount of commercial information is also included that will prove useful to investors and manufacturers of mining machinery.

Mechanical World Year Book, 1925. Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 1s. 10d., post free.

A new edition of this little reference book, containing new matter on surface condensers for steam turbines, gas engines, oil engines, diesel engines, suction gas producers, foundations for machinery, and foundry work. Certainly well worth its modest price as a handy reference book.

Idaho Phosphate—The Idaho Bureau of Mines and Geology, Moscow, Idaho, has republished for free distribution the paper by Virgil R. D. Kirkham on the "Phosphate Deposits of Idaho and Their Relation to the World Supply." This was written for the A.I.M.E.

Utah Mining and Metallurgy—The University of Utah has published a bulletin (No. 15) on "Research Investigations for the Year 1923-4" containing the following articles: "Possibilities in the Hydrometallurgy of Oxidized Zinc Ores," by R. F. Newton, G. L. Oldright, B. W. Gonser, and G. U. Greene, 27 pages; "Utah Hydrocarbons," by Albert F. Clark and Roy F. Newton, 14 pages, with bibliography; "Beneficiation of Complex Lead-Zinc Ores," by Almer J. Thompson and Thomas Varley, 10 pages; and "A Reconnaissance of the Promontory Point Mining District," by S. S. Siegfus, 16 pages. Copies may be obtained on request from the State School of Mines, Salt Lake City, Utah.

The Chamber of Commerce, Salt Lake City, has issued a bulletin on the mineral wealth of Utah, showing the great importance of this state as a mineral producer, and the sections from which the various products come.

Underground Loaders—The Dec. 1 issue of *Metall und Erz* (Wilhelm Knapp, Halle a. S., Germany) contains an 11-page article by W. Gross and W. Haertel, "Verlademaschinen unter Tage," principally descriptive of American-made machines.

Hydrometallurgy of Copper—"The Purification of Copper Sulphate Solutions" is the title of a 45-page bulletin by George S. Tilley and Oliver C. Ralston, published as Technical Paper 359 by the U. S. Bureau of Mines, obtainable for 10c. from the Superintendent of Documents, Washington, D. C. The bulletin deals with methods of removing iron, aluminum, and other impurities from copper leach solutions, from mine waters, and from solutions present in copper refining and bluestone precipitation.

Missouri Mining—The biennial report of the Missouri State Geologist is now available, 143 pages, from H. A. Buehler, Rolla, Mo. Activities among the various metallic and non-metallic mineral producers are summarized, with lists of operating companies. The last part of the report is devoted to stream flow records.

Mining in New South Wales—The Department of Mines, Sydney, New South Wales, has issued the following separate bulletins describing mineral deposits and operations in that country: No. 10, "Silica," 19 pages, by L. F. Harper, 1s.; No. 15, "Diatomite, Siliceous Earths, and Sands," by E. J. Kenny, 18 pages, 1s.; No. 12, "Coke," 45 pages, by L. F. Harper and H. P. White, 1s. 9d.; No. 14, "Asbestos, Emery, Fluorspar, Fuller's Earth, Graphite, Phosphates, Talc, and Soapstone," by H. G. Raggatt, 31 pages, 1s.; No. 11, "Cadmium and Mercury or 'Quicksilver'," by E. J. Kenny, 12 pages, 1s.; No. 8, "Aluminium (Alunite and Bauxite)" by L. F. Harper, 21 pages, 1s.; and No. 7, "Gold," by E. J. Kenny, 60 pages, 2s.

California Mining—"California Mineral Production for 1923" has been issued as Bulletin No. 94 by the California State Mining Bureau, Ferry Building, San Francisco, 162 pages, obtainable on request. Production data for the year are arranged by both counties, and metals and minerals.

New Machinery and Inventions

A Compressed-Air-Driven Blower for Auxiliary Mine Ventilation

A new centrifugal blower for delivering air through small ventilating pipes of great length has been announced by the Coppus Engineering Corporation, Worcester, Mass., under the name of "Ventair." It is made in two sizes, with 6- or 8-in. outlet or with 8-, 10- or 12-in. outlet, the latter having the greater capacity.

The blower is driven by compressed air. With only 33 cu.ft. of free air compressed to 60 lb. gage, the smaller size delivers 455 cu.ft. of air per minute at the outlet of 1,400 ft. of 8-in. flexible tubing. It is compact, rugged and light, and withstands rough usage. The two sizes weigh 90 and 190 lb. respectively.

In construction, the blower consists of a centrifugal fan casing having a stationary shaft of high-carbon steel rigidly mounted in the center of the casing cover. The fan, which is of aluminum, has shrunk around its periphery a manganese-bronze ring carrying the air turbine buckets. Fan and air turbine constitute a single unit, light and rigid, rotating at high speed on a stationary shaft. The fan hub is fitted with a bearing bushing of generous wearing surface and very high anti-friction properties.

The lubrication is said to be reliable and constant. From the grease cup in the end of the stationary shaft, grease is forced through the hollow center of the shaft into a large chamber inside the bushing and thence distributed by a spiral groove over the entire wearing surface. Little attention is required, since an occasional turn of the cup cap keeps the bushing in proper running condition.

The air inlet nozzles are renewable. The smaller size has one which works at pressures from 60 to 80 lb. gage. The larger has two; when the air pressure is above 50 lb., one only is used. Below 50 lb. pressure two such nozzles are used.

The new blower is intended for auxiliary mine ventilation, to blow out dust-laden air from the ends of drifts, to ventilate raises, tunnels, and "dead ends," and for similar work under varied conditions, under which, the manufacturer claims, it renders reliable and efficient service.

A New Quarry and Mining Shovel

Believing that the first cost of a shovel is of minor importance compared with a low maintenance cost, especially for severe service, such as in quarries, mines, and for other work where extremely hard digging conditions are met, the engineers of the Bucyrus Co., South Milwaukee, Wis., have developed a 4-yard, full-revolving shovel, which, they claim, combines the strength, power, and speed of a railroad-type shovel with the greater mobility and the full-circle swing of a revolving shovel. This machine is known as the 120-B. It is caterpillar mounted and may be operated by steam or electricity.

The shovel is built with the close-coupled strength, sturdiness, and digging power of the railroad-type shovel. For example, the boom is about the same length as that on a 115-ton railroad-type shovel, and, at the same time, its shafts are designed with from 30 to 50 per cent greater strength than has been heretofore used in conservative design.

The base and the revolving frame are of solid-casting construction, without structural work, rivets, or bolts. These units incorporate even greater solidity of design than the heavy front-end construction of a railroad-type shovel. Refinements of design include superheater equipment, fire-brick arch in the boiler, and brass shell bearings, never before offered as standard.

The grate area of the boiler is 10 per cent more, and the heating surface 15 per cent greater than the most powerful railroad-type shovel, it is stated. With superheater equipment, the boiler efficiency is further increased by the reduction of water and coal consumption by from 20 to 30 per cent.

The manufacturer states that it is the largest shovel that has yet been mounted on caterpillars.

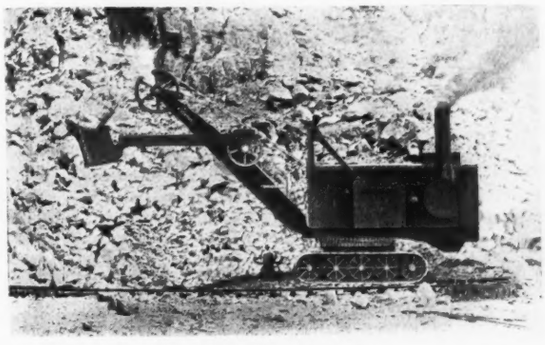
This shovel has been brought out by the company to meet the growing demand for a quick-acting full-revolving shovel of large dipper capacity, with greater strength, greater power, and greater mobility than heretofore produced, and at the same time with clearances which will enable it to operate in confined spaces and narrow cuts. It is not intended for work where very wide digging and dumping reaches are required.

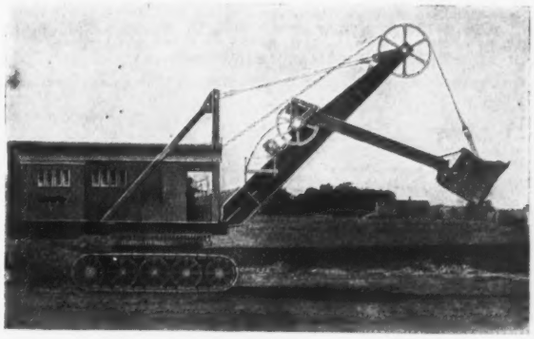
Hand-Starting Compensators Redesigned

The General Electric Co. hand-starting compensators bearing the type designation CR-1034 have been redesigned. These compensators are for use on alternating-current circuits for starting induction motors of the squirrel-cage type.

Temperature overload relays have been incorporated in the compensator, replacing dashpot overload relays. In one of the sizes multiple-rated auto-transformer coils are used instead of the single-rated variety. The redesigned compensators also include an improved push-button mechanism, containing an attachment for resetting the temperature overload relay.

Closer overload protection is expected with the newer type of relay. The multiple rated auto-transformer coils, where used, permit the use of one compensator for several horsepower ratings for a given voltage. The incorporation of the relay resetting function in the push button simplifies the operation of the device, making it unnecessary to open the compensator for this purpose.





Left — New quarry and mining shovel, steam-driven. Right — Same shovel, electrically operated.

Trade Catalogs

Refractories—The second edition of "Refractories and Furnace Design" has been issued by the Plibrico Jointless Firebrick Co., Chicago, Ill. It is a treatise on the building of monolithic furnace linings with the company's Plibrico product.

Pyrometers—A very complete catalog on pyrometers is that just issued by Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill. It contains 54 pages of descriptive matter, data and illustrations, including several full-size sample chart sections.

Dynamometers—Chatillon's traction dynamometers for ascertaining the pulling power of tractors and locomotives and for use when stringing trolley wires and transmission lines as well as for other like purposes are described in a pamphlet issued by John Chatillon & Sons, 85-99 Cliff St., New York. An article "The Place of Field Testing in Industry," reprinted from *Electrical World*, is included in this pamphlet.

Laboratory Apparatus — A 4-page circular of the Palo Company, 153 West 23d St., New York, includes brief descriptions and prices of various items in its line of apparatus for industrial and laboratory use.

The Market Report

Daily Prices of Metals

Apr.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
16	13.10	49.875	50 625	8.00	7.60@7.65	6.90@7.00
17	13.00	50.75	51.50	7.80@8.00	7.45@7.50	6.75@6.85
18	13.00	50.75	51.50	7.80@7.85	7.40@7.45	6.75
20	13.00	50.50	51.25	7.80@7.85	7.40@7.45	6.80
21	13.05	51.50	52.25	7.65@7.75	7.30	6.825@6.85
22	13.05@13.125	52.00	52.75	7.65@7.75	7.30	6.85
Av.	13.040	50.896	51.646	7.825	7.425	6.831

*The prices correspond to the following quotations for copper delivered: April 16th, 13.35c.; 17th, 18th and 20th, 13.25c.; 21st, 13.30c.; 22d, 13.30@13.375c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Apr.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
16	60½	61½	63½	229	232	32⅜	31¾	34¾	33¼
17	59⅝	60⅝	63	233¼	236¼	31 13/16	31⅜	34 7/16	33⅛
20	59⅞	60⅞	63	232¾	235¾	31 5/16	31	34¼	33 3/16
21	59⅞	60⅞	63¼	234¾	237¾	30¾	30⅝	34 5/16	33 3/16
22	60	61	63⅝	239½	242	31⅜	31¼	34 5/16	33 5/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Apr.	Sterling Exchange "Checks"	Silver		Gold London	Apr.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
16	4.78⅛	66⅞	31 7/16	86s 7d	20	4.78⅛	66⅞	31⅜	86s 6d
17	4 78⅛	66⅞	31 7/16	86s 7d	21	4.78⅝	67	31 7/16	86s 6d
18	4.78⅛	66⅞	31½	.....	22	4.79⅛	66¾	31 5/16	86s 4d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Foreign Advance Helps Domestic Metal Markets

New York, April 22, 1925—The week ending today has been another one of disappointment for metal producers, with copper, zinc, and lead prices reaching new lows for the current movement. In the last day or two, however, sentiment at least has been better, and the stronger markets in London today in all of the metals except silver have resulted in advancing quotations here for copper, zinc, and tin. No turn in lead prices is yet in evidence. Consumers generally are continuing to buy from hand to mouth, apparently preferring to wait until more strength appears before taking any speculative interest.

Copper Prices Advanced Today

Copper prices fell rapidly from the 13½c. delivered level of last Wednesday, sales being made on Thursday at both 13¼ and 13⅜c. Thereafter, until yesterday afternoon, practically all sellers were getting 13¼c., with many producers out of the domestic market. By Tuesday noon, the 13¼c. copper seems to have been cleaned up, quotations since then being at the 13⅜c. level, though some business has been done between these levels. Most of the buying has been for May delivery, though consumers are beginning to show some interest in June. Certainly, forward buying has not been in nearly so much evidence recently.

Foreign prices have ruled somewhat above the domestic market, sales being quite active yesterday at 13.45@13.55c., c.i.f., and slightly higher prices being asked by some sellers today. Much of the buying has been of an arbitrage character, caused by the close approach of standard and electrolytic prices in London. However, it is this foreign demand that is largely responsible for an increase in prices for domestic deliveries; certainly, demand has not been active enough to warrant any advance.

An encouraging factor for the copper industry is the announcement of a cut in production by one of the largest producers. This is to take effect immediately and will amount to about 5,000,000 lb. per month. Should other prohere has not been active enough to cause any advance.

Further Fall in Lead Prices

The weakness of the lead market has been well illustrated by the rapidity with which revisions downward in the contract price of the American Smelting & Refining Co. were made. Last Thursday, April 16, the New York contract price dropped one-quarter cent to 8c. per lb.; on April 18 a reduction to 7.85c. was announced and on April 21 the price was cut to 7.75c.

Lead has been pressed for sale both in the West and East, but the total amount of metal sold has been light. Activity seemed centered in St. Louis, where the bulk of the business was done. Consumers made many inquiries throughout the week, but bought sparingly and generally urged immediate shipment—"or sooner" (!). Naturally, in a declining market they have been refraining from buying as long as possible, so that a large amount of business is piling up pending a more stable market. Today, with a turn in the London market upward, a better sentiment is noticeable, but this sentiment has not crystallized into a change of prices upward or of hardening of the market. Lead is still available at 7.30c., St. Louis, the low for this movement and the price at which the metal was sold on Tuesday. In the latter part of last week lead in the Middle West brought 7.60 to 7.65c. The market is now reaching a point where the accumulation of normal stocks of lead becomes attractive.

Zinc at 6.85c.

Zinc prices declined to 6¾c. on Saturday, when several hundred tons were sold at that level. A few good-sized orders were placed during the week, and, also, interest was again shown in the export market, though most of the export business was from dealers who may later resell in the domestic market. Prices have reacted up to 6.85c., at which level several sales were made

today. Spot zinc has been somewhat harder to obtain than forward, though prices are about the same for all deliveries; May has been most in demand. The premiums asked in the last week or two for Brass Special, about $3 per ton, no longer hold, $2 being about all that can be obtained now, and that may be high. High-grade continues unchanged at 8½@8¾c., with producers well sold up.

Tin Moves Higher

With an improved market in London, prices of Straits tin in New York moved upward daily, carrying quotations from 50½c. to 52¾c. today. Arrivals of tin were exceptionally heavy during February, March, and April, which had a tendency to depress spot prices. In the last ten days this situation has changed, so that now forward tin—June shipment—commands a premium of one-quarter cent. For a time the New York tin market was the cheapest in the world, but it is so no longer. Consumers have been only moderately interested, with brokers and dealers playing a leading part in establishing prices.

Silver Market Inactive

"Quiet" is the report from the silver markets of the world. China continues a negligible factor, and Indian bazaar buying during the last week was apathetic, the slight advance on the 21st having been occasioned by a temporary demand from the Continent. Under these conditions it is not surprising that prices have sagged, establishing a new low quotation for the year in London on the 22d.

Mexican Dollars—April 16th, 17th, 18th, and 20th, 51½c.; 21st, 51⅝c.; 22d, 51⅜c.

Foreign Exchanges Higher

All foreign exchanges improved slightly during the week. On Tuesday, April 21, closing cable quotations on francs were 5.225c.; lire, 4.10125, and marks, 23.81c. Canadian dollars advanced to par.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £125.

Antimony—
Chinese brands, 11.50@12c. per lb.
Cookson's "C" grade 15¾c.
Chinese needle, lump, nominal, 10c.

Standard powdered needle, 200 mesh, 11½@13c.

White oxide, Chinese, 99 per cent Sb_2O_3, 16c. nominal.

Bismuth—$1.95 per lb., in ton lots. London, 7s. 6d.

Cadmium—60c. per lb. London, 2s. 2d.@2s. 6d.

Iridium—$375@$400 per oz. London £70.

Nickel—Ingot, 31c.; shot, 32c.; electrolytic, 38c.; London, £170 per long ton.

Palladium—$79@$83 per oz. London £17.

Platinum—$118.50 per oz. refined. London, £25 per oz.
Crude, $114.50.

Quicksilver—$83 per 75-lb. flask. San Francisco wires $81.35. Quiet. London £13½.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the prices given in the April 4 issue.

Metallic Ores

Chrome Ore—$22.50@$23 per ton, c.i.f. Atlantic ports.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports:

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range, $4.55.

High phosphorus foundry, over 0.18 per cent P, $4.15.

Tungsten Ore—Per unit, N. Y.:
Chinese wolframite, $11.
High-grade Western scheelite, $11 nominal.

Galena Radio Crystals, Manganese, Molybdenum, Tantalum, and **Vanadium Ores** are unchanged from April 4 quotations.

Zinc Blende and Lead Ore Prices Show Further Declines

Joplin, Mo., April 18, 1925

Zinc Blende	Per Ton
High	$53.55
Premium, basis 60 per cent zinc	$49.00@$50.00
Prime Western, 60 per cent zinc	$47.50
Fines and slimes	$45.00@$43.50
Average settling price, all.	$50.61

Lead Ore	
High	$117.80
Basis 80 per cent lead	$90.00
Average settling price, all	$106.90

Shipment for the week: Blende, 14,136; calamine, 32; lead, 2,040 tons. Value all ores the week, $934,670—the first time this year less than one million dollars.

In ceasing night-shift operations and with a number of mills closed down for repairs the output was reduced to approximately 14,000 tons this week, less than the shipment and less than the purchase for next week's shipment, which was 15,000 tons.

Buyers expected some objection among sellers to accept a basis offering of $47.50 this morning and were surprised to find the market easy and little effort to fill orders. Several of the stronger companies are withholding ore from the market, both zinc and lead.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from April 4 prices.

Mineral Products

Arsenious Oxide (white arsenic)—5½c. per lb. Imported material offered at substantial concessions.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from April 4 prices.

Ferro-Alloys

Ferromanganese—Domestic, German, and English, $115 per gross ton, f.o.b. works, or duty paid at seaport.

Ferrosilicon—10 to 12 per cent, $34@$40 per gross ton, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrotitanium, Ferrotungsten, Ferrouranium and **Ferrovanadium** are unchanged from the prices given in the April 4 issue.

Metal Products

Zinc Sheets—10c. per lb.

Copper Sheets—Base price 21.25c. Wire, 15.375c.

Nickel Silver—18 per cent Grade A sheets, 28c. per lb.

Yellow Metal—Dimension sheets, 18.75c. per lb.; sheathing and nails, 17.75c.

Lead Sheets are unchanged from the issue of April 4.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and **Zirkite** are unchanged from April 4 prices.

Steel Consumption Good

Pittsburgh, April 21, 1925

After averaging 90 per cent in the first quarter and reaching 93 per cent in the forepart of March, steel mill operations have dropped below 85 per cent, and further declines are in prospect. In view of the conservative attitude of all jobbers and manufacturing consumers, present buying at 50 to 60 per cent of mill capacity indicates heavy current requirements. The agricultural-implement industry is running at its best rate in five years, the automobile industry is now at a high rate, and fabricated steel contracts let in the last five weeks exceed the average of earlier in the year.

Third-quarter tin-plate order books were opened today, with no change from the $5.50 price. Sheets have eased off a trifle more in price in the last week. Bars, shapes, and plates are unchanged, mills holding prices because they have contracts to protect. Wire products are dull and rather soft. Prices of merchant pipe and oil-country goods have not changed for two years.

Though steel mills have been unable to maintain the heavy first-quarter pace, all indications now are that the year will be one of heavy production and consumption.

Pig Iron—Bessemer and basic are off 50c.: Bessemer, $21; basic, $20; foundry, $20.50, f.o.b. Valley furnaces. Buying is light.

Connellsville Coke—Production decreasing. Spot furnace coke easier at $3@$3.15; spot foundry unchanged at $4@$4.50.

Company Reports

Utah Copper Co.

Throughout 1924 both the Arthur and Magna mills of the Utah Copper Co. were in continuous operation, treating a total of 12,126,600 dry tons of concentrating ore, an average of 33,406 tons per operating day. Including a small quantity of copper recovered by precipitation from mine waters, a total of 214,592,733 net pounds of refined marketable copper was produced during the year, which, with the proceeds of precious metals recovered, resulted in a gross operating revenue of $30,130,651.39.

The net credit to surplus was $8,185,319.51, equivalent to $5.04 per share on the 1,624,490 shares of stock outstanding at the close of the year.

The average cost of production was 8.89c. per net pound of copper, as compared with a cost of 8.74c. per pound for the previous year. These costs for both periods are exclusive of depletion and federal tax accruals, but include current charges for depreciation and all administrative and general expenses, and apply gold and silver values and miscellaneous earnings as a credit to copper costs.

Four quarterly distributions were made to stockholders, aggregating $6,497,960 for the year, being at the rate of $4 per share per annum. The total of all disbursements to stockholders up to Dec. 31, 1924, was $131,815,787.50

Capital expenditures involving in the aggregate a cash outlay of $1,454,696.48 were made during the year.

There was mined during the year 12,126,600 tons of milling ore, leaving, of the reserves previously reported, 335,251,449 tons, averaging approximately 1.35 per cent copper.

Consolidated Statement of Assets and Liabilities

Assets

	Dec. 31, 1924	Dec. 31, 1923	Increase
Mining and milling properties and equipment	$32,882,638.94	$31,990,116.04	
Railway property and equipment	7,463,531.47	7,068,756.19	
	$40,346,170.41	$39,058,872.23	
Less reserve for depreciation	9,561,708.49	8,668,903.58	
	$30,784,461.92	$30,389,968.65	$394,493.27
Investments	5,938,572.65	5,937,474.83	1,097.82
Deferred charges to operations	12,475,497.79	11,608,223.66	867,274.13
Bond deposit account	545,000.00	545,000.00	
Current assets	23,932,292.67	23,359,290.53	573,002.14
	$73,675,825.03	$71,839,957.67	$1,835,867.36

Liabilities

Capital stock outstanding (Utah Copper Co.)	$16,244,900.00	$16,244,900.00	
Current liabilities	5,146,492.47	4,965,844.06	$180,648.41
Surplus from sale of securities	8,290,620.00	8,290,620.00	
Surplus from operations	43,993,812.56	42,338,593.61	1,655,218.95
	$73,675,825.03	$71,839,957.67	$1,835,867.36

Statement of Operations for the Year Ended Dec. 31, 1924

Operating revenue		
Copper produced—214,592,733 lb. @ 13.121c.	$28,156,890.58	
Gold produced—76,907.102 oz. @ $20	1,538,142.04	
Silver produced—652,586.23 oz. @ 66.75c.	435,618.77	
		$30,130,651.39
Operating expenses		20,478,945.96
Profit from operations		$9,651,705.43
Miscellaneous income, net		614,053.05
Total income		$10,265,758.48
Charges against income		
Depreciation	$1,175,650.02	
Loss on plant and equipment retired	241,536.66	
Federal income tax and other charges	663,252.29	2,080,438.97
Net income to surplus account		$8,185,319.51
Surplus from Operations		
Balance Dec. 31, 1923		$40,471,947.04
Net income for year (without deduction for depletion)		8,185,319.51
		$48,657,266.55
Less		
Dividends paid	$248,553.19	
Capital distributions	6,249,406.81	6,497,960.00
Balance of surplus Dec. 31, 1924		$42,159,306.55

Nevada Consolidated Copper Co.

Nevada Consolidated Copper Co.'s net operating earnings for 1924 amounted to $2,277,228.65. After writing off the regular charge for depreciation of plant and equipment, the net amount of earnings carried to surplus was $1,675,509.77, representing a net profit of 84c. per share of capital stock outstanding.

There was produced during the year a total of 70,237,050 lb. of refined marketable copper, the cost of which was 10.70c. per pound, including taxes, except federal, all fixed and general administration expenses, and current charges to provide for depreciation of plants and equipment. The cost stated is after crediting miscellaneous income and the values of gold and silver recovered, but does not include any charge for depletion.

Capital expenditures during the year amounted to $1,394,-621.77.

The properties as a whole have never before been in such perfect condition and readiness to produce heavily and economically.

Ore reserves total 57,225,060 tons averaging 1.641 per cent copper.

Combined Statement of Assets and Liabilities

Assets

	Dec. 31, 1924	Dec. 31, 1923
Property, equipment and construction	$22,838,326.98	$21,443,084.79
Less ore extinguishment and depreciation	12,953,465.01	12,233,665.71
	$9,884,861.97	$9,209,419.08
Investments in securities and rights	58,599.23	58,599.23
Deferred charges to mining operations	6,362,323.46	5,905,371.63
Bond deposit account	150,000.00	150,000.00
Materials and supplies on hand	1,723,788.26	1,813,989.01
Accounts and notes collectible	739,428.81	571,337.56
Deferred accounts	786,825.27	498,316.48
Metals on hand and in transit	5,163,418.76	5,718,573.92
Marketable securities	234,700.00	234,700.00
Cash	1,890,084.27	1,468,998.53
	$26,994,030.03	$25,629,305.44

Liabilities

Capital stock outstanding (Nevada Consolidated Copper Co. only)	$9,997,285.00	$9,997,285.00
Surplus (from capital stock and securities sold in excess of par value or cost)	7,071,850.17	7,071,850.17
Accounts payable	1,098,318.59	1,120,100.17
Deferred accounts	94,536.73	123,495.09
Unpaid treatment on metals	395,837.59	610,797.12
Surplus from operations	8,336,201.95	6,705,777.89
	$26,994,030.03	$25,629,305.44

Statement of Operations

Operating revenue		
Copper produced—70,237,050 lb. @ 13.086c.	$9,191,489.66	
Gold produced—32,151.599 oz. @ $20.501	659,136.18	
Silver produced—104,993.94 oz. @ 66.856c.	70,196.40	
		$9,920,822.24
Operating expenses		8,128,931.97
Profit from operations		$1,791,890.27
Miscellaneous income		485,338.38
Total income		$2,277,228.65
Charges against income		
Depreciation		601,718.88
Net income to surplus account		$1,675,509.77
Surplus from Operations		
Balance Dec. 31, 1923		$5,876,491.91
Net income for year—(without deduction for depletion)		1,675,509.77
Balance of surplus Dec. 31, 1924		$7,552,001.68

Ray Consolidated Copper Co.

The annual reports of the Ray mines and the Chino mines of the Ray Consolidated state that during 1924 a total of 5,602,900 tons of ore, of an average copper content of 1.56 per cent, was treated at the concentrating plants of both properties, and 51,638 tons of direct-smelting ore was shipped to reduction works.

The average mill recoveries of gross copper contained in concentrates was 78.05 per cent, equivalent to 24.29 lb. per ton of ore milled.

The total net refined copper produced, including that contained in direct-smelting ore, was 133,592,467 lb.

The average cost per pound of net copper in marketable form was 11.30c. That cost covers all operating, administrative and general expenses, taxes and all other costs or

charges except depreciation. The value of precious metals recovered and other income from miscellaneous sources amounting to 0.22c. per pound are applied as a credit to production costs.

Net surplus earnings for 1924 amounted to $974,143.89.

Capital expenditures were incurred during the past year to the amount of $1,488,172.00. The properties have never before been in such perfect physical condition as now, or so ready to respond rapidly and with increasing efficiency to production requirements.

Ray Consolidated Copper Co. and Ray & Gila Valley R.R., Comparative Combined Balance Sheet

Assets

	Dec. 31, 1924	Dec. 31, 1923 (Including Chino assets)
Mining and milling property	$11,315,973.79	$10,827,714.51
Construction and equipment—mines, mills and railroad—less depreciation	11,769,127.20	12,463,083.33
Development, stripping and deferred charges	12,751,948.43	12,102,073.58
Total	$35,837,049.42	$35,392,871.42
Investments	5,203,822.07	4,876,448.72
Bond deposit account	240,000.00	240,000.00
Unadjusted debits and prepaid insurance	238,510.23	241,131.90
Materials and supplies	2,145,959.48	2,534,685.74
Accounts receivable	1,130,530.80	970,663.26
Metals on hand and in transit	6,754,138.09	7,285,672.80
Cash	1,835,044.46	2,562,688.00
	$53,385,054.55	$54,104,161.84

Liabilities

Capital stock of Ray Consolidated Co., outstanding	$30,771,790.00	$30,771,790.00
Accounts payable	806,078.58	2,454,056.78
Treatment, refining and delivery charges—not yet due	1,002,407.60	764,409.00
Reserve for taxes, insurance, and other expenses	1,749,780.71	2,033,678.75
Paid-in surplus	5,426,205.54	5,454,993.25
Surplus from operations	13,628,792.12	12,634,234.06
	$53,385,054.55	$54,104,161.84

Ray Consolidated Copper Co., Statement of Operations

Operating revenue		
Copper produced—133,592,467 lb. @ 13.045 c.	$17,427,073.42	
Gold produced—2,533.772 oz. @ $20	50,675.45	
Silver produced—233.44 oz. @ 67.6 c.	157.77	$17,477,906.64
Operating expenses		15,388,069.23
Profit from operations		$2,089,837.41
Miscellaneous income		328,851.20
Total income		$2,418,688.61
Charges against income		1,444,544.72
Net income to surplus account		$974,143.89

Surplus from Operations

Balance Dec. 31, 1923		$12,475,245.85
Net income for year (without deduction for depletion) as above	$974,143.89	
Charged Chino Copper Co. surplus prior to transfer Feb. 15, 1924	28,787.71	1,002,931.60
Balance Dec. 31, 1924		$13,478,177.45

Inspiration Consolidated Copper Co.

Operations of the Inspiration Consolidated Copper Co. were carried on throughout 1924 without interruption. The production was 90,709,878 lb. of fine copper, a monthly average of 7,559,156 lb. The grade of the ore mined, averaging 1.135 per cent copper, was below the average grade and was lower than anticipated, due largely to the delay in placing in operation the new Porphyry shaft, through which the ore from the Live Oak section is hoisted. This shaft and surface equipment was completed Nov. 25.

During the year 5,504,565.8 dry tons of ore was mined.

The cost of fine copper produced during the year, including depreciation but excluding depletion and federal taxes, amounted to 11.0251c. per pound of copper.

Balance Sheet, Dec. 31, 1924

Assets

Fixed		$32,168,640.79
Current		5,085,427.14
		$37,254,067.93

Liabilities

Capital stock		
Authorized—1,500,000 shares of $20 each		
Issued—1,181,967 shares		$23,639,340.00
Reserve depreciation		4,561,675.15
Current		1,356,986.55
Surplus		
Balance Dec. 31, 1923	$5,992,473.58	
Net income, year ended Dec. 31, 1924	1,703,592.65	7,696,066.23
		$37,254,067.93

Income Account

Sales of copper		$12,430,177.38
Expenses	$12,665,207.96	
Less copper on hand at end of year	2,360,491.81	10,304,716.15
		$2,125,461.23
Depreciation on buildings and equipment		408,748.17
		$1,716,713.06
Interest paid		48,617.17
		$1,668,095.89
Income from investments		35,496.76
Balance, net income for year, carried to balance sheet		$1,703,592.65

American Zinc, Lead & Smelting Co.

A statement of the result of operations of the American Zinc, Lead & Smelting Co. and its subsidiary companies for 1924, follows:

Profits from operations	$426,233.02
Deduct—net interest on bonds	66,295.16
Total profit	$359,937.86
Earned surplus at Dec. 31, 1923	1,991,807.84
	$2,351,745.70
Deduct amount transferred to depletion and depreciation	425,090.24
Earned surplus at Dec. 31, 1924	$1,926,655.46

Consolidated Balance Sheet, Dec. 31, 1924

Assets

Property account	$12,422,000.43
Investments	1,957,013.90
Cash in sinking fund for retirement of bonds	8,088.60
Current assets	2,651,612.09
Deferred charges to operations	95,707.77
	$17,134,422.79

Liabilities

Capital stock issued	$7,242,000.00
First mortgage bonds	1,019,200.00
Reserves for depletion, depreciation, insurance and sundries	6,256,742.35
Current liabilities	650,190.35
Special surplus arising from revaluation of mineral lands at March 1, 1913, less portion realized and transferred to depletion reserve	39,634.63
Earned surplus	1,926,655.46
	$17,134,422.79

As usual, the stockholder is given no information about the production record of the company's units.

United States Smelting, Refining & Mining Co.

Consolidated Profit-and-Loss Account

Earnings, after charging cost of production, selling expenses, reserves for federal taxes, etc., but before providing interest on funded debt and reserves for depreciation, depletion, and amortization		$6,902,806.23
Less interest on funded debt		730,393.50
Earnings after deducting all charges except reserves for depreciation, depletion, and amortization		$6,172,412.73
Less reserves for depreciation, depletion and amortization		2,572,465.92
Profits for 1924		$3,599,946.81
Surplus as per previous balance sheet		$17,219,795.16
Add profits for 1924		3,599,946.81
		$20,819,741.97
Less additional reserves for depreciation, depletion and amortization	$1,800,000.00	
Dividends on preferred stock at 7 per cent per annum	1,702,225.00	3,502,225.00
Surplus as per balance sheet		$17,317,516.97

Production was as follows:

		Percentage in Value of Each Product
Copper, pounds	22,820,024	8.4
Lead, pounds	101,140,943	23.0
Zinc, pounds	33,609,388	6.0
Silver, ounces	23,420,141	42.9
Gold, ounces	191,395	10.9
Byproducts and miscellaneous		3.2
Coal, tons	730,460	5.6
		100.0

Earnings of U. S. S., R. & M. Co. for 1924, after deducting all charges except reserves for depreciation, depletion, and amortization, amounted to $6,172,412.73, comparing with $4,389,572.38 in 1923. Metal prices realized during 1924 were on the whole somewhat higher than in the previous year, but the increase in earnings is principally accounted

for by increased tonnages and better-grade ores, with resulting reduction of costs, and by more satisfactory metallurgical results.

The output of silver and gold from the properties of the Mexican subsidiaries was further increased and again exceeded the production of any previous year. The mills treated an average of 100,197 tons per month comparing with the previous record of 94,570 tons treated in 1923. The grade was maintained, and the resulting profits continued to be satisfactory.

Consolidated Balance Sheet Dec. 31, 1924

Assets			
Total capital assets			$79,695,717.15
Less reserves for depreciation, depletion, and amortization			20,328,034.52
Capital assets at net book values			$59,367,682.63
Options and other deferred charges			1,574,542.52
Total current assets			20,053,733.16
			$80,995,958.31
Liabilities			
Capital stock of U. S. S., R. & M. Co.:			
Common			$17,555,887.50
Preferred			24,317,775.00
Total authorized, $75,000,000.00, issued			$41,873,662.50
Capital stocks of subsidiary companies not held by company and proportion of profit-and-loss accounts applicable to minority stocks			2,114,058.11
Funded debt			12,140,400.00
Total capital liabilities			$56,128,120.61
Current liabilities			5,732,517.78
Reserves for contingencies			1,817,802.95
Profit and loss account:			
Balance at Dec. 31, 1923		$17,219,795.16	
Profit for 1924		3,599,946.81	
		$20,819,741.97	
Less additional reserves for depreciation, depletion and amortization	$1,800,000.00		
Dividends on preferred stock	1,702,225.00	3,502,225.00	17,317,516.97
			$80,995,958.31

Phelps Dodge Corporation

In 1924 the metals produced from the ores of branches and subsidiaries of the Phelps Dodge Corporation were 175,211,078 lb. of copper, 6,340,089 lb. of lead, 1,545,441 oz. of silver and 34,335 oz. of gold. There were also produced from purchased ores smelted 992,440 lb. of copper, 111,530 oz. of silver, and 1,296 oz. of gold.

Including copper received from other sources, 277,881,973 lb. was sold at an average price of 13.281c. per pound, divided as follows:

	Pounds
To domestic trade	203,379,744
To foreign trade	74,502,229

The corporation sold:

	Pounds
Of its own mine product	195,055,594
Of copper from ores purchased	1,789,093
Of copper on commission	81,037,286

Because of the greater purchasing power of Europe, the corporation sales of copper abroad increased from 22 5/16 per cent of total sales in 1923 to 26 5/16 per cent in 1924.

In general the year's operations in the West can be considered as highly satisfactory, in that production cost has been lowered, through greater efficiency and the application of minor improvements in mining and metallurgical processes.

Consolidated Balance Sheet, Dec. 31, 1924

Assets			
Fixed			$198,187,287.84
Current			28,935,947.10
			$227,123,234.94
Liabilities			
Capital stock—authorized and issued—500,000 shares			$50,000,000.00
Deferred—£316,530 outstanding preference stock of the Arizona Copper Co., Ltd., to be retired prior to Sept. 30, 1926			1,540,446.00
Current			16,616,205.55
Reserves			
Depletion	$59,587,167.94		
Depreciation	17,998,954.33		
Fire insurance and miscellaneous	441,928.19		78,028,050.46
Surplus			
Balance Dec. 31st, 1923	$86,876,530.60		
Income, before depletion, for the year 1924	2,091,275.91		
	$88,967,806.51		
Deduct depletion for 1924	6,029,273.58		
	$82,938,532.93		
Dividends declared	2,000,000.00		80,938,532.93
			$227,123,234.94

Consolidated Income Account

Income		
Sales of metals, fuel, and merchandise	$35,611,014.53	
Income from investments and miscellaneous earnings	227,474.48	$35,838,489.01
Expenses		
Cost of metals, fuel and merchandise	$30,646,444.72	
Provision for depreciation	2,335,652.62	
Interest	765,115.76	33,747,213.10
Income, before depletion, for the year 1924, carried to balance sheet		$2,091,275.91

Texas Gulf Sulphur Co.

For the three months ended March 31, 1925, Texas Gulf Sulphur Co. made net earnings of $1,413,093.73. With this amount added, total surplus and reserve for depletion at March 31, 1925, was $7,409,127.75, after having paid a dividend of $1,111,250 on March 14, 1925.

April Dividends Show Increase

The following dividends were paid by mining and metallurgical companies operating in the Americas, in April, 1925:

Companies in the United States	Situation	Per Share	Total
Barnes-King Development, g	Mont.	$0.60 L	$240,000
Cresson Consolidated Gold	Colo.	0.10 Q	122,000
Eagle-Picher Lead, pfd	Okla.	1.50 Q	12,984
Gladstone Mountain, l	Wash.	0.005 M	6,609
Great Northern Iron Ore	Minn.	1.00 K	1,500,000
Homestake Mining, g	S. D.	0.50 M	125,580
Inland Steel, pfd	Minn.	1.75 Q	175,000
Kennecott Copper	Alaska	0.75 Q	3,197,823
Nichols Copper, pfd	N. Y.	1.75 Q	40,434
Park City, s. l. z	Utah	0.15 Q	131,400
Phelps Dodge, c	Ariz., Mex.	1.00 Q	500,000
Republic Iron & Steel, pfd	Various	1.75 Q	437,500
Silver King Coalition, s, l	Utah	0.20 Q	243,220
Sloss-Sheffield Steel & Iron, pfd	Ala.	1.75 Q	117,250
Tonopah Belmont Development, s, g	Nev.	0.05 K	75,000
Tonopah Extension, s, g	Nev.	0.05 Q	69,636
Tonopah Mining, s, g	Nev.	0.075 SA	75,000
U. S. Smelting, Refining & Mining, pfd.	Various	0.875 Q	425,556
U. S. Smelting, Refining & Mining	Various	0.75	263,336
Utah Apex, l, c, s, g	Utah	0.35 Q	184,870
Companies in other countries			
Ahumada Lead, l, s	Chihuahua	0.25 Q	$296,754
Asbestos Corporation, pfd	Quebec	1.50 Q	60,000
Dome Mines, g	Ontario	0.50 Q	500,000
Erupcion, l, s	Chihuahua	0.20 Q	250,000
Hollinger Consolidated Gold	Ontario	0.05 4 wks.	246,000
Kerr Lake, s, g	Various	0.125 SA	75,000
Lorrain Trout Lake, s	Ontario	0.05 I	75,000
Lucky Tiger-Combination Gold	Sonora	0.11 M	78,687
N. Y. & Honduras Rosario, g, s	Honduras	0.50 QX	100,000
Nipissing Mines, s	Ontario	0.15 Q	180,000
Premier Gold, s, g	B. C.	0.08 Q	400,000
Silversmith, s, l, z	B. C.	0.01 Q	25,000
Wright-Hargreaves, g	Ontario	0.05 Q	137,500
Total			$10,367,139

g, gold; l, lead; s, silver; z, zinc; c, copper; L, liquidation dividend; Q, quarterly; M, monthly; K, irregularly; SA, semi-annually; I, initial; X, includes 25c. extra.

Dividends for April were about $1,000,000 greater than those for the preceding quarter, ending in January, and about $3,000,000 greater than those paid last October. They were somewhat below those paid in April, 1924, however, because the Great Northern Ore Properties paid only $1,500,000, compared with $3,000,000 at that time.

Barnes-King Development has decided to dissolve the corporation and paid its first liquidation dividend, of 60c., on April 10. Tonopah Belmont paid its first dividend in two years, the last payment also being at the rate of 5c. a share, on April 2, 1923. United States Smelting resumed dividends on the common stock, which had not been paid since Jan. 15, 1921, and Utah Apex increased its dividend from 25 to 35c. a share.

Among the companies outside of the United States, Ahumada increased its dividend from 15 to 25c. a share, and its twin sister, Erupcion, increased from 15 to 20c. At the rate of 80c. a year, Erupcion yields about 27 per cent on the investment, though the mine is not expected to have so long a life as Ahumada. Ahumada, by the way, has just been listed on the New York Stock Exchange. We welcome Lorrain Trout Lake as a brand new addition to our dividend columns. Its property is near the Keeley, in the new South Lorrain district of Ontario, and it is one of those properties that gets enough ore in shaft sinking to pay all its development costs. A third of its stock is owned by the Mining Corporation of Canada, which has kept stockholders waiting since 1920.

To wind up with the bad news, Nipissing and Silversmith paid only half as much as in January, and Premier Gold, British Columbia's famous silver producer, paid 8c. instead of 10c.

Current Prices of Mine Materials and Supplies

Rise and Fall of the Market

There are about four items in the following list of prices, in which there is any semblance of firmness, namely, steel bars, transmission belting, rope and hollow tile. Declines were noted during the month in steel sheets; pine, hemlock, spruce and fir timbers; red and white lead; litharge and linseed oil. The general price trend is, at present, downward.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.50@2.70	$3.90	$3.80	$4.20	$3.89
Black No. 28	3.30@3.50	4.80	4.50	5.25	4.60
Galvanized No. 28	4.45@4.60	5.60	5.55	6.25	5.60

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, 9/16-in. and larger	$2.90	3.00@3.15	$3.55	$3.65	$4.35	$2.90
Track bolts	3.90@4.25	4.00@4.25	4.45	4.55	5.85	3.90
Standard section angle bars	2.75	2.75	3.30	3.40	4.00	3.85

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.00@2.10	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channel, 3 to 15 in.	2.00@2.10	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 6 in., ¼ in. thick	2.00@2.10	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	2.00@2.10	2.10	3.34	4.15	3.25	3.10	3.30
Plates	2.00@2.10	2.00	3.34	4.15	3.25	3.10	3.30

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD—	½ to 3	62	50½	¼ to 1¼	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
3½ to 6 in. lap welded	48%	56½%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$52.60–53.60	$61.60–63.60	$48.20–50.20	$46.70–48.20	$47.60	$55.00

NUTS—Semi-finished, ½x¼-in., 2c. each. Discount 70% for 5/16-in. and smaller; 65% for ⅜-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1162	$0.1179	$0.06	$0.1325	$0.08	$0.108	
6x12x12	.1743	.1769	.0825		.108	.156	$0.252*
8x12x12	.2179	.2211	.1125	.25	.150	.244	.312†

* 10x12x12; † 12x12x12

MACHINE BOLTS—¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$45.00	$46.00	$31.00	$32.00
3x10 to 10x10	49.00	50.00	35.00	36.00
3x12 to 12x12	53.00	54.00	39.00	40.00

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$52.00	$48.00†	$50.00	$50.00	$62.00	$58.00
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Denver	.....	33.75	33.75	.....	.....	34.75
Minneapolis	41.00	39.75	39.00	.....	43.50	39.75
Kansas City	42.00	40.75	.....	.....	53.60	41.75
Birmingham	32.00	.....	.....	.....	34.00	.....

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.85@2.95	$3.25	$4.00	$4.28	$3.33	$4.95
Cut	2.90	....	5.25	5.00	3.58	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.60	$2.50@2.60	$2.50@2.60
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.39

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel 280-lb. net Finishing	Lump, per Barrel 280-lb. net Common
New York	$18.20	$12.@13.10	$3.50	$2.50@$2.75
San Francisco	22.00	.....	....	(180-lb. net) 1.60

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$1.09	$0.95	$1.26	$0.94

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.75	15.00	17.25	16.50
White	15.75	15.00	15.75	15.00

HOSE—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket ..... 56c per ft.

Air—Best Grade
¾-in., per ft. ..... 3 ply $0.33 4 ply $0.40

Steam—Discounts from List
First grade ..... 40% Second grade ..... 40–5% Third grade ... 40–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.
Best grade ..... 50–5% Second grade 50–10–5%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	30–10%
Heavy	20–5%

RAWHIDE LACING—For cut, best grade, 45–5%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45–5%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ¼ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.27	New Orleans	$0.23½
New York	.27	Seattle	.17
Chicago	.21½	San Francisco	.26

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.233	.26
San Francisco	1625	.1925

FLOTATION OIL—

Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal.	$0.35

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.08½
Litharge, f.o.b. New York, kegs, per 100 lb	15.75
Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb.	.18@.22

Mining Stocks

Week Ended April 18, 1925

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb			*6		
Anaconda	New York	39¼	36⅜	37	Ap.16, My.23,	0.75
Arcadian Consol.	Boston	1⅛	1⅛	1⅛		
Ariz. Com'l	Boston	11	10¼	10⅜	Ja. 19, Ja. 31	0.50
Calaveras	N. Y. Curb			1⅛		
Calumet & Arizona	New York	48⅜	47⅛	47⅛	Mh.6, Mh.28 Q	0.50
Calumet & Hecla	Boston	14	13	13⅛	Ja.30, Mh.4	0.50
Canario Copper	N. Y. Curb	3⅜	3⅛	3⅜		
Cerro de Pasco	New York	47	45⅛	46⅜	Ap.23 My.1, Q	1.00
Chile Copper	New York	32⅜	31⅞	32⅛	Mh.3,Mh.20, Q	0.62½
Chino	New York	21	20⅜	21	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	3⅛	3	3⅛		
Copper Range	Boston	22⅛	20⅜	20⅜	Ap.9, My.4	1.00
Crystal Copper	Boston Curb	*63	*60	*60		
Davis-Daly	Boston			*7	Mar., 1920	0.25
East Butte	Boston	3⅞	3¾	3⅞	Dec., 1919	0.50
First National	Boston Curb	*20	*17	*17	Feb., 1919	0.15
Franklin	Boston	*95	*60	*95		
Gadsden Copper	Boston Curb	*50	*45	*45		
Granby Consol	New York	15	14⅛	15	May, 1919	1.25
Greene-Cananea	New York	13⅛	12⅛	13⅛	Nov., 1920	0.50
Hancock	Boston			*75		
HoweSound,new,r.t.c.	N. Y. Curb	18⅜	17	17	April, 1924	0.05
Inspiration Consl.	New York	23⅛	22⅛	22⅞	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	1⅛	1⅛	1⅛	May, 1923	0.15
Isle Royale	Boston	13⅜	13	13	Sept., 1923	0.50
Jerome Verde Dev	N. Y. Curb	1⅜	1⅜	1⅜		
Kennecott	New York	49⅛	47⅝	48	Mh.6, Ap.1, Q	0.75
Keweenaw	Boston	*75	*75	*75		
Lake Copper	Boston	1⅜	1¼	1¼		
Magma Copper	New York	39⅞	37⅛	38⅛	Jn. 15, Jy. 15,	0.75
Mason Valley	N. Y. Curb	1⅜	1⅛	1⅛		
Mass Consolidated	Boston	*60	*60	*60	Nov., 1917	1.00
Miami Copper	New York	10⅞	10⅛	10⅜	My.1 My.15 Q	0.25
Mohawk	Boston	29⅛	27½	28	My. 2, Jn. 2	1.00
Mother Lode Coa.	New York	7	6⅞	6⅞	De. 12, De. 31	0.37½
Nevada Consol.	New York	13⅞	13⅜	13⅜	Sept., 1920	0.25
New Cornelia	Boston	20⅛	19⅝	19⅝	My. 8, My. 25Q	0.25
North Butte	Boston	1⅞	1⅛	1⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*98	*85	*87	No.14, De.2	0.05
Old Dominion	Boston	19⅛	19	19	Dec., 1918	1.00
Phelps Dodge	Open Mar.	112	107		Mh 20, Ap.2 Q	1.00
Quincy	Boston	23½	22	23⅛	Mar., 1920	1.00
Ray Consolidated	New York	13	12⅛	12⅝	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			14		
St. Mary's Min. Ld.	Boston	38⅛	32⅛	32⅛	Ap. 20, My.20,	3.00
Seneca Copper	New York			⅛		
Shannon	Boston	*75	*75	*75	Nov., 1917	0.25
Shattuck Arizona	New York	5⅛	5⅛	5⅛	Jan., 1920	0.25
Superior & Boston	Boston	1 1/16	1	1 1/16		
Tenn. C. & C.	New York	8⅜	8	8⅛	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	24	24	24	Ap. 3, Ap. 15	1.00
Utah Copper	New York	85⅛	84	84	Mh.20,Mh.31,Q	1.00
Utah Metal & T.	Boston	*65	*58	*60	Dec., 1917	0.30
Victoria	Boston	*35	*35	*35		
Walker Mining	Salt Lake	2.90	2.60	2.75		
Winona	Boston			*16		
NICKEL-COPPER						
Internat. Nickel	New York	29⅞	28⅛	28⅞	March, 1919	0.50
Internat. Nickel pfd.	New York	98⅛	97⅛	97⅛	Ap.16, My.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	6⅛	5⅞	5⅞		
Gladstone M. M. Co.	Spokane	*20⅛	*20	*20⅛	Ap. 1925	0.00½
National Lead	New York	146	144½	144¼	Mh.13,Mh.31,Q	2.00
National Lead pfd.	New York	116½	116	116	My.22, Jn.15 Q	1.75
St. Joseph Lead	New York	47⅞	44⅞	46⅞	Mh. 5, Mh. 20	0.50
ZINC						
Am. Z. L. & S.	New York	8⅛	7¾	7⅞	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	28⅞	26½	28⅞	Nov., 1920	1.50
Butte C. & Z.	New York	6	5⅜	5⅜	De.10, De.24	0.50
Butte & Superior	New York	15⅝	10⅞	11⅛	Mh.19, Mh.31	0.50
Callahan Zn-Ld	New York	3¼	2⅞	2⅞	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	188⅝	188	188	Ap.20, My.9	2.00
United Zinc	N. Y. Curb			*35		
Yellow Pine	Los Angeles	*70¼	69	70¼	De.10,De.15 Q	0.04
SILVER						
Alvarado	Boston Curb			2	Oct. 1920	0.50
Beaver Consol.	Toronto	*33½	*25	*32	May, 1920	0.03
Castle-Trethewey	Toronto	*80½	*78	*80		
Coniagas	Toronto	1.40	1.40	1.40	May, 1924	0.12½
Keeley	Toronto	2.00	1.96	1.99	Mh.1, Mh.15SA	0.12
Kerr Lake	N. Y. Curb	1⅛	1⅛	1⅛	Ap.1, Ap.15,Q	0.12½
La Rose	Toronto	*50	*39	*46½	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.15	1.15	1.15	Ap. 15, 25	0.05
McKinley-Dar.-Sav.	Toronto	*33	*30½	*32¼	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.84	2.72	2.76	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6	5⅞	5⅞	Mh.31, Ap.21	0.15
Ontario Silver	New York			6½	Jan., 1919	0.50
Temiskaming	Toronto	*18½	*18	*18¼	Jan., 1920	0.40
GOLD						
Alaska Juneau	New York	1⅞	1⅞	1⅞		
Argonaut	Toronto	*35	*34	*34		
Carson Hill	Boston	*35	*30	*30		
Consol. W. Dome L.	Toronto	*15½	*14¼	*15		
Cresson Consol. G.	N. Y. Curb	3½	3⅜	3⅜	Mh.31, Ap.10 Q	0.10
Crown Reserve	Toronto	*37	*36	*36½	Jan. 1917	0.05
Dome Mines	New York	13⅜	12⅞	13⅛	Mh.31, Ap.20,Q	0.50
Golden Cycle	Colo. Springs			1.44	Dec.11, 1924	0.03
Hollinger Consol.	Toronto	14.30	13.85	14.25	Ap.6. Ap.22, M	0.05
Homestake Mining	New York	44¼	43¾	44	Ap.20 Ap.25 M	0.50
Jib. Consol.	N.Y. Curb	*11	*6	*7		

Stock	Exch.	High	Low	Last		Last Div.
Kirkland Lake	Toronto	*43½	*37½	*42½		
Lake Shore	Toronto	5.61	5.60	5.60	Mh.2, Mh.16,	0.05
McIntyre-Porcupine	New York	17	16¾	17	My.1, Jn.1,	0.25
Newray	Toronto	*21½	*21	*21		
Night Hawk Pen.	Toronto	*25	*25	*25		
Portland	Colo. Springs			*50	Oct., 1920	0.01
Rand Mines	New York			35½	Fe.17, Fe.25	1.79
Teck-Hughes	Toronto	1.42	1.39	1.40		
Tom Reed	Los Angeles	*65	*55	*65	Dec., 1919	0.02
Tough-Oakes	Toronto	*32	*31½	*31½		
United Eastern	N. Y. Curb	*53	*50	*53	July, 1924	0.05
Vipond Cons.	Toronto	1.15	1.14	1.14		
Wright-Hargreaves	Toronto	4.45	4.35	4.45	Mh.16,Ap.1,QX	0.05
GOLD AND SILVER						
Black Oak	N. Y. Curb			*81		
Con. Cortez	N. Y. Curb	*10	*10	*10		
Con. Virginia	San Francisco	*6½	*6½	*6½		
Continental Mines	N. Y. Curb			1¼		
Dolores Esperanza	N. Y. Curb	*50	*50	*50	July, 1923	0.05
Premier Gold	N. Y. Curb	2½	2⅜	2⅜	Mh.23, Ap.3,	0.08
Tonopah Belmont	N. Y. Curb	*65	*64	*65	Mh.15, Ap.1	0.05
Tonopah Divide	N. Y. Curb	*21	*21	*21	Se. 22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2⅛	2⅛	2⅛	Mh.11, Ap.1, Q	0.05
Tonopah Mining	N. Y. Curb	1⅝	1⅝	1⅝	Mh.31, Ap. 21,	0.07½
Unity Gold	N. Y. Curb	*52	*50	*50		
West End Consol.	N. Y. Curb			*26	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*35	June, 1918	0.02
SILVER-LEAD						
Ahumada	N. Y. Curb			12	Mh.16, Ap.2,X	0.25
Bingham Mines	Boston	32¼	31⅛	32	Mh.20, Mh.31	0.50
Cardiff M. & M.	Salt Lake			1.25	De.16, No.18	0.10
Chief Consol.	Salt Lake			4.00	Ap. 10, My. 1	0.10
Columbus Rexall	Salt Lake			*19	Aug., 1923	0.05
Eruption	Boston Curb	3⅛	2⅛	3	Mh.16, Ap.2,X	0.20
Federal M. & S.	New York	15⅞	15⅞	15⅞	Fe.26, Mh.15 Q	1.75
Federal M. & S. pfd.	New York	52	51⅛	51⅛	No.25, De.15,	1.75
Florence Silver	Spokane	*4	*2⅛	*2⅛	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	15⅛	15⅛	15⅜	Fe.15, Mh.15	0.50
Iron Blossom Con.	Salt Lake	*36	*36	*36½	Oc.25, 1924	0.01½
Iron King Mining	Salt Lake	*60	*57	*60		
Keystone Mining	Salt Lake	*64	*63	*63		
Mammoth Mining	Salt Lake	2.52½	2.20	2.42½		
Marsh Mines	N. Y. Curb			*5	June, 1921	0.02½
Park City	Salt Lake			4.75	Mh.14, Ap.1	0.15
Park Utah	Salt Lake	3.60	3.55	3.60	April, 1924	0.15
Prince Consol.	Salt Lake	*29	*26	*29		
Silver King Coal	Salt Lake	6.50	6.50	6.50	Mh.20,Ap 1, Q	0.20
Silversmith	Spokane	*23	*20	*22	Ap.1, Ap.10	0.01
Tamarack-Custer	Spokane	*74	*70	*74	Se. 22, Se. 29	0.25
Tintic Standard	Salt Lake	9.05	8.95	9.05	Mh.23, Mh.30	0.40
Utah-Apex	Boston	7⅛	6½	6⅞	Ap.5, Ap.15,	0.35
Western Utah Copper	N. Y. Curb	*15	*15	*15		
IRON						
Bethlehem Steel	New York	43½	40⅜	42¼	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit			*40		
Char. Iron pfd.	Detroit	*95	*95	*95		
Colorado Fuel & Iron	New York	34½	33⅜	33⅜	May, 1921	0.75
Gt. North'n Iron Ore	New York	28⅞	28⅛	28¼	Ap.11, Ap.30	1.00
Inland Steel	New York	41⅞	40¼	41	Fe.14, Mh.20 Q	0.625
Mesabi Iron	N. Y. Curb	2⅝	2⅜	2⅝		
Replogle Steel	New York	15⅞	14⅝	14⅞		
Republic I. & S.	New York	47¼	43⅞	46	May, 1921	1.50
Republic I. & S. pfd.	New York			88	Mh.8, Ap.1, Q	1.75
Sloss-Sheffield S. & I.	New York	85	82½	85	Mh.10, Mh.20Q	1.50
Sloss-Shef. S.&I. pfd.	New York	92½	92½	92½	Mh.20, Ap.2, Q	1.75
U. S. Steel	New York	118⅛	114⅞	118	Fe.28,Mh.30,QX	1.75
U. S. Steel pfd.	New York	123⅛	122⅝	123	Fe.1, Fe.27, Q	1.75
Virginia I. C. & C.	New York			36⅛	De.15, Ja.2	1.50
Virginia I.C.&C.pfd.	New York			75	De. 13, Ja. 2, Q	2.50
VANADIUM						
Vanadium Corp.	New York	27¼	26½	27¼	Jan., 1921	1.00
ASBESTOS						
Asbestos Corp.	Montreal	65	65	65	Fe.1, Fe.15 Q	2.00
Asbestos Corp. pfd.	Montreal	92½	92	92½	Ap.1, Ap.15, Q	1.50
SULPHUR						
Freeport Texas	New York	11⅜	10⅛	10⅞	Nov., 1919	1.00
Texas Gulf	New York	111¼	103⅞	110⅛	Mh.2, Mh.14,	1.75
DIAMONDS						
De Beers Consol.	New York	20⅛	20⅛	20⅛	Ja.6, Fe.2	0.95
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	2⅛	2⅛	2⅛		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	47⅜	46⅛	46⅜	Fe.18, Mh.2 Q	0.75
Amer. Metal pfd.	New York	113⅛	113⅛	113⅛	Fe.19, Mh.2, Q	1.75
Amer. Sm. & Ref.	New York	96⅛	93⅜	94	Ap.13, My.1, Q	1.50
Amer.Sm.&Ref.pfd.	New York	108⅛	107⅜	107¼	My.8, Jn.1 Q	1.75
Consol. M. & S.	Montreal	68⅜	66	68	De.11, Ja.15 SA	0.75
Federated Metals	N. Y. Curb			37⅛		
Southwest Metals	N. Y. Curb	*80	*80	*80		
U. S. Sm. R. & M.	New York	35	34⅛	34⅛	Ap.6, Ap.15	0.75
U.S. Sm. R.&M.pfd.	New York	44⅛	44	44	April, 1925	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

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